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AF 1 Physics of heat therapy	AF 4 Sources of heat radiation	AF 7 Physiologic effects of heat	AF 10 Physiology of massage and exercise
AC 1 Physical therapy in relation to internal medicine	AC 4 Physical therapy in arthritis	AC 7 Physical therapy in pediatrics	AC 10 Physical therapy in obstetrics and gynecology
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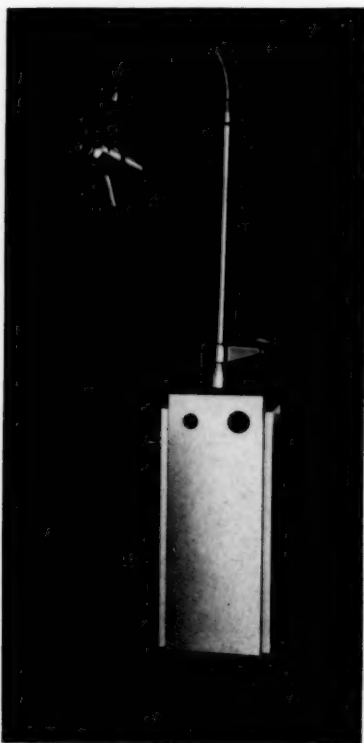
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# PRESENT STATUS OF ULTRAVIOLET IRRADIATION \*

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Section on Physical Therapy, The Mayo Clinic

ROCHESTER, MINNESOTA

In a recent presentation I<sup>1</sup> discussed chiefly the indications for the employment of ultraviolet radiant energy. In this communication I shall consider chiefly the physiologic effects of ultraviolet radiation. Such radiation produces not an immediate erythema but does produce a latent erythema which appears several hours after exposure. Following intense irradiation of the skin, the latent erythema is in turn followed by pigmentation.

Irradiation with therapeutic light rays (visible and invisible) produces two effects, one stimulative and the other lethal.<sup>2</sup> The stimulative effect is caused by wavelengths longer than 290 millimicrons, and the lethal effect by those shorter than 290 millimicrons. These actions are perhaps due to the production of a toxic photoproduct which in a small quantity may act as a stimulant to cell division. Finsen at first attributed the beneficial results which he obtained in the treatment of lupus vulgaris to the bactericidal effect of the rays, but later questioned whether the radiation did not effect cures by acting as a stimulant to the tissues. Light rays produce both photochemical and biologic effects. The photochemical effect ends with the production of dermatitis and activation of substances in the skin and possibly in the blood. The biologic effects (on metabolism, growth and circulation) last a longer time.<sup>2</sup>

The evaluation of ultraviolet radiation in medicine is one of the most difficult problems in radiometry.<sup>3</sup> Part of the difficulty results from the fact that the band of wavelengths that have healing power has not been definitely established. Practically the only definite knowledge we have is that ultraviolet wavelengths shorter than about 315 millimicrons have the power of preventing and curing rickets and of activating foods and oils (for example, ergosterol) which, in turn, have the power of curing or preventing rickets when fed to growing animals deprived of ultraviolet solar radiation. It is recognized also that ultraviolet rays have a specific effect in treatment for lupus vulgaris and surgical tuberculosis. Because of its curative effects in cases of rickets, ultraviolet radiation has been exploited as a cure-all. This is not justified although it has been noted that exposures to ultraviolet rays invoke evidence of increased bodily vigor and general well-being, an indication of the importance of ultraviolet, particularly solar rays, in our lives.<sup>2</sup>

It has been contended<sup>4-6</sup> that changes found in the spleen, lung, kidney and liver following ultraviolet irradiation were due to a direct, deep action. Congestion of these deeply lying organs was great. In the lungs, it was so severe that erythrocytes had passed through the capillary walls into the alveoli. It has been suggested<sup>7</sup> that this may explain why heliotherapy in cases of pulmonary tuberculosis is frequently followed by hemorrhage. However, the only reasonable conclusion is that some photochemical substance formed in the skin is carried by the blood stream to these organs and that this chemical substance then produces the observed changes in these organs.<sup>2</sup> Some observers believe that radiant energy absorbed by the skin gives rise to a number of useful reflexes. The energy has been thought to be carried throughout the body by the blood stream and when liberated, to stimu-

\* Read at the Nineteenth Annual Session of the American Congress of Physical Therapy, Cleveland, Ohio, September 6, 1940.

late intracellular oxidation. Rollier believed that insolation activates the circulation by dilating the capillaries, and that it might produce a continuous tonic action on the sensory nerve endings in the skin, thus tending toward restoration of the tone of the muscles, stimulation of general metabolism, and possibly an increase of resistance against disease.

Although the mechanism by which certain inner processes, such as changes in respiration, pulse rate and blood pressure, are influenced by irradiation of the skin may be explained on the basis of reflex action, there must be also some change in the capillary blood which has absorbed the ultraviolet energy<sup>8</sup>. At least part of the effects of irradiation may be produced by chemical means, by the action of radiant energy on substances formed in the skin.<sup>2</sup> These chemicals may be the end products of damaged or killed cells, or may result from increased activity on the part of the basal cells of the skin, or they may be activated substances which eventually get into the circulation and are in this way distributed to all parts of the body.

Ultraviolet irradiation produces a beneficial effect on general bodily metabolism which on the whole is stimulated.<sup>9</sup> There is an especially favorable effect on the metabolism of calcium and phosphorus. Vitamin D derived from cholesterol of the skin, after ultraviolet irradiation, promotes efficient absorption of calcium and phosphorus from the intestinal tract. Cholesterol which is contained in the cutaneous cells has the property of absorbing ultraviolet light. In the past, it was believed that cholesterol, in turn, contained an impurity, ergosterol; it was presumed that a chemical change took place when this ergosterol came in contact with absorbed ultraviolet rays. It was thought that this chemical change resulted in the production of vitamin D, which was carried into the circulation and thus exerted its beneficial effects. Recently, however, Harris<sup>10</sup> has pointed out that animals cannot absorb ergosterol; that ergosterol is a plant sterol and has never been proved to be present in animal tissue. He has said that actually the ultraviolet irradiation of a human being activates 7-dehydrocholesterol, eleidin, or some similar cholesterol derivative. It was suggested also that vitamin D<sub>3</sub> (the cholesterol type) is as potent as vitamin D<sub>2</sub> (calciferol, the ergosterol type). Eleidin (7-dehydrocholesterol) appears to be the principal activatable sterol, for provitamin, in cholesterol which is the chief sterol of animal fats. Its active form thus comprises the vitamin D, which is produced in the skin, fur or feathers of animals exposed to sunlight or other sources of ultraviolet rays. Harris said: "For several years after the activatability of ergosterol was discovered, it was assumed that traces of ergosterol were the provitamins in the sterols of animals. This concept was based on the fact that the sterols show the characteristic absorption spectrum of ergosterol more or less in proportion to their activatability. However, it was soon discovered that other D provitamins have the same absorption spectrum as ergosterol. Waddell has shown that the effectiveness of vitamin D from animal sources is greater for chickens than vitamin D produced from ergosterol. Others have shown the same type of result with vitamin D produced by skin irradiation, that is, it took perhaps twenty times as many rat units of irradiated ergosterol as of skin vitamin D to produce equivalent rachitic healing in chickens."

Irradiation of ergosterol with the full ultraviolet of the quartz mercury arc produces a multiplicity of products, some antirachitic, some physiologically inactive and some toxic.<sup>11</sup> The administration of vitamin D in the form of viosterol apparently enables the bone cells concerned in calcification to extract calcium phosphate from the blood, and vitamin D seems to

increase nuclear, cytoplasmic interchange by increasing the permeability of cytoplasmic and perinuclear membranes.<sup>12</sup>

In this manner, vitamin D increases the rate of calcium and phosphorus metabolism of the bone cells concerned in calcification by acting on their lipin constituents (particularly the lecithin moiety), and enables these cells to extract calcium phosphate from the blood by facilitating interchange through the pericellular and perinuclear membranes. The beneficial action of radiant energy and cod liver oil in both experimental and infantile rickets is, therefore, due to some action which increases metabolic efficiency. These agents probably do not bring new processes into operation, but cause the organism to make full use of previously<sup>4</sup> ineffective natural processes. Irradiated ergosterol, when ingested, will increase absorption of calcium.<sup>13</sup> When the skin is irradiated with ultraviolet rays of the proper wavelength the same effect may be expected. There is a similarity between the actions of ultraviolet rays and of cod liver oil on calcium and phosphorus metabolism.<sup>9</sup>

It has frequently been observed clinically that patients who become pigmented easily are most benefited by ultraviolet radiation,<sup>14</sup> but some observers believe that pigmentation of the skin interferes with rather than aids in the utilization of ultraviolet energy by the body. Melanin, the brown pigment which is produced in the skin of human beings on exposure to ultraviolet radiant energy, is similar to chlorophyll, the green pigment which is produced in plants when they are exposed to ultraviolet energy. When human beings are excluded from exposure to ultraviolet light they become pale and melanin is not present in the skin. In a similar manner, in plants which are kept out of the sun, stalks and leaves become white, and chlorophyll is not present.

Vitamin A appears to be associated in some way with greenness; that is, with the relative development of chlorophyll in plants. Dry seeds and etiolated plants (plants grown in darkness) are as a result poor sources of vitamin A. Mushrooms which thrive in darkness are very deficient in vitamin A.<sup>15</sup>

In a similar manner, vitamin D appears to be associated in some way with tanning, that is, with the relative development of melanin in the skin of the human being, and humans deprived of sufficient ultraviolet radiation show, as a rule, a deficiency of vitamin D. Children who live in darkness are pale and usually deficient in vitamin D (they usually have rickets unless the deficiency is compensated for by a proper diet). It is probable that there is some relationship between melanin and ergosterol, and between chlorophyll and phytosterol. The exact nature of these relationships has not yet been determined. Some investigators<sup>16</sup> have ascribed to melanin a property of sensitization to long waves of light resembling that which is held by chlorophyll in the plant.

Higher plants must depend fundamentally on radiant energy from the sun and probably our knowledge of the manner of utilization of light by such plants is still incomplete, for we know only of the importance of heat and of the utilization of light in photosynthesis of carbohydrates.<sup>7</sup>

There is a universal conviction that sunlight exerts a beneficial effect on health, and recently much clinical and experimental evidence has been amassed which leaves no room for doubt that sunlight has a healthful effect on human beings.<sup>7</sup>

It may be that vitamins take up an excess of energy from the ultraviolet rays or from other sources, and that this excess is readily liberated within the body, thus facilitating certain chemical reactions. Vitamins may simply be photo-electrically or photochemically activated atoms and molecules.<sup>17</sup> The incipient effect is photo-electric; nevertheless, photochemical

reactions ensue<sup>2</sup> and new substances are formed in the skin which finally pass into the blood stream and produce a variety of effects.

### Various Effects of Ultraviolet Irradiation

*Effects on the Skin.* — Skin which has not been exposed to sunlight is toneless, inelastic and white with a yellowish tinge; it tends to be gray and very dry. In contrast, this same skin after three or four weeks of daily exposure to summer sunlight may appear entirely changed. The pale, anemic, wrinkled skin usually becomes tanned and full-blooded with a texture and sheen of velvet, and even that portion of the skin which has not been exposed to the sun becomes pink, soft, smooth and elastic. The color of the skin serves, to some extent, as an index of the state of well-being of the individual and the appearance of the skin may be an indicator of health or disease.<sup>2</sup> It is a general custom, followed by practically everyone, to speak of "a healthy suntan" or of "an unhealthy pallor."

The initial erythematous reaction of the skin after ultraviolet irradiation is generally crisis-like in form, but may also be plateau-like or double crisis-like. The course of the erythema is rhythmic or wave-like in nature and persists over a period of weeks. In the same individual the amount of pigment formation following ultraviolet irradiation is proportional to the degree of the preceding erythema.<sup>13</sup>

The lipids of the skin, after exposure to ultraviolet rays, are bactericidal. Although normal lipids extracted from the skin contain some active oxygen, the content of active oxygen is much increased by irradiation. When emulsified in salt solution, the irradiated lipids, in comparison with emulsions of lipids which have not been irradiated, kill hemolytic streptococci more promptly than otherwise would be the case.<sup>19</sup>

It is well known that ultraviolet rays may produce denaturation or coagulation of cutaneous proteins. However, the production of erythema, which is supposed to be due to release of a vasodilator substance in damaged tissue, is probably not related to this coagulation of proteins by ultraviolet radiation.<sup>20</sup>

Ultraviolet irradiation may be used as a readily controlled method of applying counterirritation to the skin.<sup>21</sup>

*Effects on the Eye.* — Inflammation of the eye produced by ultraviolet rays seems to differ from that caused by exposure to intense radiation with visible and infra-red rays, such as is caused by power burns from the flash of a short circuit or from an explosion.<sup>22</sup> The effects produced by the latter appear instantly, there being temporary blindness, severe pain and redness of the eyes which increases in severity for a few hours and then subsides. On the other hand, the inflammation from ultraviolet burns does not appear until six to eighteen hours after exposure. Vision is not affected but there is temporary impairment of accommodation and severe deeply seated pain. There is also moderate external inflammation. The pain and headache may last for many weeks and the vision may be blurred when close work is attempted. Attempts to accommodate may aggravate the pain. An abnormal sensitiveness to ultraviolet radiation may persist almost indefinitely. It is doubtful whether there is any direct specific action of ultraviolet radiation on the retina, since only very small quantities ever reach it.

It has been said<sup>23</sup> that ultraviolet radiation exerts great therapeutic effects on inflammatory, ulcerative and degenerative diseases of the cornea. Ultraviolet radiant energy is of definite value in treatment for certain ophthalmologic diseases.<sup>24</sup>

*Effects on the Blood.* — A summary of opinions based on the literature<sup>25</sup> would indicate that irradiation with sunlight or artificial sunlight is fol-

lowed by an increase in the number of erythrocytes, leukocytes, blood platelets and in the concentration of hemoglobin and in a decrease in the hydrogen ion concentration, coagulation time, and eventually in blood volume, whereas, in general, darkness seems to cause the reverse, with the exception that the blood volume seems also to be diminished.

Favorable results may be obtained in treatment for primary and secondary anemias by heliotherapy,<sup>26</sup> although it is admittedly merely an adjunct. When the serum of a patient who has pernicious anemia is irradiated it becomes much less toxic. It seems probable that a normal number of erythrocytes may be slightly increased, and that an abnormally low number of erythrocytes may be raised to normal by daily exposures to ultraviolet radiation.<sup>27</sup>

Various studies have shown that ultraviolet irradiation will not serve as a substitute for dietary deficiencies. Irradiation is effective chiefly by virtue of the fact that it enables the organism to utilize more effectively materials which are present but not available.

There is little evidence that sunlight and artificial radiant energy influence specific immunity, although it is extensively believed that they benefit general health and that by increasing the bactericidal power of the blood they increase the general resistance of the body to infection.

A definite increase in serum globulin is produced by ultraviolet irradiation.<sup>28</sup> Ultraviolet irradiation causes an increased viscosity and shifting of the stability of the globulins, with a shift in the opposite direction for the albumins.<sup>29</sup>

Oxyhemoglobin and its compounds and derivatives have a main ultraviolet band in the region of 400 millimicrons, a small band at 375 millimicrons and a broad band in the region of 340 millimicrons.<sup>30</sup> There is no basis for the hypothesis that the intense band at 400 millimicrons in hemoglobin compounds is related to the valence of iron.

*Effects on the Blood Pressure.* — Irradiation of the entire body with sunlight or artificial radiant energy approximating sunlight will usually produce lowering of the blood pressure. When a single erythema-producing dose of carbon arc radiation is administered to dogs, the outstanding effect is a diminution of both blood pressure and cardiac output. Among normal men, the blood pressure shows a slight lowering (5 mm. of mercury, systolic and 8 mm., diastolic), which lasts one to two days and is accompanied by an average increase of 21 per cent in cardiac output. The highest value for cardiac output is reached on the second or third day after irradiation with a return to normal by the fifth or sixth day. In the presence of hypertension, there is a consistent and more extreme degree of lowering particularly of the systolic blood pressure, the average drop being 17 mm. of mercury for the systolic and 7 mm. for the diastolic pressure. The cardiac output was generally increased.

The vasodilation produced by irradiation is considered by some to be limited to the cutaneous region, whereas others believe that such vasodilation extends to the internal vessels as well. The greatest increase in cardiac output occurs on the second, third or even the fourth day after exposure, whereas erythema always reaches its height within the first twenty-four hours; therefore, it is suggested that there is a gradual spread of the vasodilation, which might be explained by assuming that some H-substance, liberated from the skin, is being circulated through the body.<sup>31-32</sup>

It has been suggested<sup>2</sup> that several factors are responsible for such lowering of blood pressure: (1) the production of cutaneous hyperemia, (2) decrease in viscosity of the blood, (3) production, in the skin, of depressor



substances which, getting into the blood stream, lower peripheral resistance, (4) breathing of depressor substances (when artificial sources are used), such as oxides of nitrogen and similar compounds set free by the arc, and (5) sympathetic hypotonia.

Experimental and clinical studies have shown that, particularly in the presence of pre-existing hypertension, massive irradiation with a carbon arc lamp produces some lowering of blood pressure.

The slight uneasiness and vertigo sometimes observed following the production of extensive erythema are probably due to cerebral anemia secondary to the severe degree of vasodilation of superficial vessels.

In a series of 166 observations on dogs it was shown<sup>33</sup> that inhalation of products of combustion of carbon arc radiation does not lower blood pressure, for there was no drop of it in control dogs that inhaled the fumes from the lamp but were screened from the rays. The fall in blood pressure produced by exposure to radiant energy has been attributed<sup>34</sup> to sympathetic hypotonia, rather than to cutaneous hyperemia, for it has been found possible to produce a fall without there being any cutaneous hyperemia, and to find no drop in pressure when there was marked hyperemia. It was observed that there was a fall in blood pressure which lasted several days and that this was paralleled by a marked decrease in the concentration of blood sugar, increased sugar tolerance and decreased secretion of epinephrine, all of which are characteristic of sympathetic hypotonia.

Irradiation of a solution of histidine with ultraviolet light results in the formation of a substance which is capable of causing a fall in blood pressure. There is evidence to show that this substance (probably either histamine or imidazoleacetaldehyde) is formed during the production of erythema by light and that this causes the initial reddening.<sup>35</sup>

*Effects on Muscles.* — A number of clinical investigators have noted that ultraviolet irradiation produces a remarkable improvement in the tone of unused muscles. Improvement in the tone of the heart muscle has been observed experimentally<sup>36</sup> and it has been shown that isolated muscles from frogs receiving daily injections of irradiated ergosterol have a greater consumption of oxygen than is present in controls.<sup>37</sup> Likewise, from experiments on the *Limulus* heart including the dorsal ganglion, it appeared that an accelerator substance may be produced by ultraviolet irradiation of the *Limulus* muscle.<sup>38</sup>

Short ultraviolet irradiation (two to three minutes) of the clam heart appears to cause a marked increase in tonus, and a definite decrease in amplitude but does not affect the pacemaker.<sup>39</sup>

*Effects on General Metabolism.* — Small doses of ultraviolet radiation stimulate the endocrine system whereas large doses produce a protein shock reaction.<sup>40</sup>

Increased protein metabolism and increased elimination of nitrogen, followed by a compensatory retention have been reported following irradiation of human beings with a quartz mercury lamp.<sup>41</sup> There was an increased elimination of chlorides, sulfates and phosphates and at first there was an increase in appetite and a decrease in weight, as is seen following muscular exercise.

A single, large, general exposure to ultraviolet radiation, sufficient to cause severe inflammation of the skin, has been shown<sup>34</sup> to produce a considerable increase in serum calcium. The irradiation probably exerts an influence on the cutaneous sympathetic nerve endings, which causes lowering of sympathetic tone and produces hypo-adrenalemia, lowered concentration of blood sugar, increased sugar tolerance, lowered blood pressure, relative lymphocytosis and eosinophilia.<sup>34</sup>

The fasting blood sugar of diabetic patients exposed to ultraviolet radiation is reduced as much as it would have been by 3 or 4 units of insulin. On the following day, however, the concentration of blood sugar rises again. It is presumed that decrease in blood sugar caused by ultraviolet irradiation is due to increased oxidation.<sup>42</sup>

*Effects on Fat Metabolism.* — Irradiation with the quartz mercury vapor lamp may double the fat content of the blood, may increase the blood cholesterol by 30 per cent and decrease the fat-splitting ferment of the blood.<sup>43</sup> Increases as great as 15 to 43 per cent in blood cholesterol may occur following a few minutes of ultraviolet irradiation, the increase reaching a maximum soon after irradiation and subsiding completely in approximately ninety-six hours.<sup>44</sup> Increases in the blood cholesterol of tuberculous patients have been reported<sup>45</sup> following irradiation with a quartz mercury vapor lamp.

Ultraviolet irradiation may play an important role in correcting the frequent partial lack, in the diet, of components which are necessary for the formation of bone. Ultraviolet irradiation activates sterols within the body to form vitamin D. These sterols are derived from plants. The animal is dependent on the plant for its supply of vitamins. The vitamins in the milk fat of cows are derived from the green foods which they eat, as the vitamins in cod liver oil are derived indirectly from the minute diatoms which are exposed to ultraviolet rays as they float on the surface of the sea.

When an individual is exposed to weak doses of ultraviolet radiant energy, no effect on the carbon dioxide tension is produced.<sup>46</sup> A moderate dose, however, causes an increase of carbon dioxide tension and a relative alkalosis of the blood. A heavy dose produces decreased carbon dioxide tension and acidosis. The intensity of the reaction depends on the receptivity of the skin. Following ultraviolet irradiation there is usually an increase of carbon dioxide tension which, it is suggested, is due to an increase in the content of base in the blood returning from the cutaneous regions; a decrease in the acid products of metabolism, and an alternation in the colloidal state of the blood proteins, that result in a greater dissociation of alkaline protein compounds.

*Effects on Calcium and Phosphorus Metabolism.* — Although the exact reason why ultraviolet radiation affects the absorption of calcium and phosphorus has not been clearly determined, we do know that it plays an important part in the promotion of intestinal absorption of these substances. Following ingestion of cod liver oil or exposure to radiant energy, there is an increased assimilation of calcium.<sup>47-48</sup> Also, calcium and phosphorus storage and equilibrium can be influenced by irradiation with the mercury quartz lamp.<sup>49</sup> It has been suggested<sup>50</sup> that, as physical agents, the ultraviolet rays act synergistically with the parathyroid glands, and that stimulation of the incretory functions of the skin results in the production of viosterol which influences calcium metabolism, if not at the same level as the parathyroid hormone, at all events in parallel with it. It has been shown that ultraviolet irradiation will produce re-establishment of normal calcium metabolism in conditions of hypocalcemia.

The uniformity of the rate of removal of ingested calcium chloride has been demonstrated in normal dogs.<sup>51</sup> The administration of sufficient parathyroid extract or irradiated ergosterol to produce a fasting hypercalcemia will cause a decreased rate of removal of calcium from the blood stream of dogs.

Experiments have been undertaken<sup>52</sup> with young monkeys in an attempt to prove whether or not repeated dosage with viosterol may really be harm-

ful to children despite complete absence of clinical signs of injury. During the administration of a concentrated preparation of viosterol the average amount of calcium with serum was unchanged. Serum phosphorus was increased. Histologic modifications were inconspicuous. There was no clinical reason to suppose that the treatment had been injurious, with the exception that in two mature monkeys of a different species, reactions were so different as to indicate that it is unjustifiable to predict what may be happening in children.

Studies<sup>53</sup> on the effect of solar irradiation and of ingestion of cod liver oil on the production, fertility and incubation of eggs indicated that irradiation favorably influenced the normal development of chicks hatched from abnormally incubated eggs. Irradiation with a mercury quartz lamp increased the hatch of abnormally incubated eggs, indicating, it was believed, that ultraviolet rays produce an accessory action in maintaining normal metabolism. Absence of the antirachitic vitamin from the diet will result in improper calcification of bones, even when calcium and phosphorus balance is normal and when their supply is adequate. This antirachitic vitamin has been said to be "prepotent" in preventing rickets, and is capable of such action in the absence of any natural or artificial ultraviolet irradiation.<sup>2</sup>

Furthermore, as far as the effects on the retention of calcium and phosphorus are concerned, the actions of cod liver oil and of ultraviolet rays are interchangeable, but all of the physiologic effects of these two agents are not interchangeable. Cod liver oil has much less general beneficial action than ultraviolet rays; the latter produce more general improvement in the activity, muscular tone and contentment of rachitic infants.

Rickets may usually be attributed to an imperfect process of absorption of calcium and phosphorus rather than to their deficiency. In the absence of an increase in the intake of calcium and phosphorus, ingestion of cod liver oil or ultraviolet irradiation may produce increased absorption of these substances from an intestine and an increase in their concentration in the serum to such a point that deposition of calcium phosphate in the bones becomes possible and an excess is excreted in the urine.

### Conclusions

Ultraviolet irradiation produces photochemical effects with activation of substances in the skin and possibly in the blood. Biologic effects such as stimulation of metabolism, cellular activity, growth and circulation are also produced. Ultraviolet radiation in wavelengths shorter than 315 millimicrons will prevent and cure rickets. These rays, in wavelengths shorter than 315 millimicrons, will impart an antirachitic potency to fats, milk, ergosterol, 7-dehydrocholesterol (eleidin), oils and vegetables. Such radiation causes delayed or latent erythema of the skin of human beings, improves the tone, color and elasticity of the skin and presumably increases the cutaneous secretory and protective powers. Also, irradiation with ultraviolet energy will increase the active oxygen content of the lipids of the skin, thus increasing their bactericidal action.

On general exposure to ultraviolet radiation there will be produced an increase in the number of erythrocytes, leukocytes, blood platelets and hemoglobin of the circulating blood and a decrease in the hydrogen ion concentration, coagulation time and eventually in the blood volume. A transient lowering of blood pressure is produced by exposure to ultraviolet rays.

From wavelengths longer than 290 millimicrons there are presumably stimulative effects on the human body. Wavelengths shorter than 290 millimicrons may produce lethal effects on cells of the human body.

General exposures to ultraviolet rays improve muscular tone, increase the metabolism of proteins and minerals and increase the ability of the organism to utilize more effectively materials which are present but not available.

Finally, ultraviolet irradiation will impart an antirachitic potency to the milk of cows or pregnant or nursing mothers.

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### Discussion

**Dr. Edwin L. Libbert** (Lawrenceburg, Ind.): Dr. Krusen has presented several interesting features which research workers might use as a guide for further investigation, and which may result in a more adequate evaluation of ultraviolet therapy. It is interesting to note that the generally accepted ideas regarding the therapeutic use and effect of ultraviolet irradiation follow closely the physiologic action and that we no longer advocate its use as a cure-all simply because it cures rickets.

Questions as to the extent of biologic and photochemical changes produced by irradiation must concern the skin, capillary structure and its permeability, and the blood stream all together as well as separately. There is raised the question of storage of excess irradiation which requires further investigation. For example: Pigmentation resulting from irradiation disappears long after the irradiation has stopped and the clinical effects of such irradiation seem to parallel the course of pigmentation. Is the excess irradiation stored in melanin or in some vitamin or provitamin in the skin and how is it liberated? Is there a selective absorption characteristic of each layer of the skin? Study must be continued relative to the effect of particular wave bands on these structures. Further study is indicated concerning the relationship between skin reflexes and skin proteins, the effect on the nervous system as a result of stimulating sensory nerve ends through excessive irradiation. There is also the question of the effect on the sympathetic and para-sympathetic nervous systems and their interrelations with the endocrine system.

Dr. Krusen repeatedly emphasized the fact that ultraviolet irradiation does not create new body materials and processes, but rather enables the body correctly to utilize previously ineffective natural processes; and his discussion of calcium and phosphorus metabolism in its relation to Vitamin D clearly elucidates this fact. Blood pressure elevations are frequently associated with an increase in blood cholesterol. Is it a natural corollary that since heavy irradiation results in a fall of blood pressure and an increased blood cholesterol, the body makes its own effort to reduce pressure by metabolic changes involving increased cholesterol?

**Dr. Norman E. Titus** (New York): I am afraid one of the statements made early in this paper was taken from a very old book on ultraviolet light. Twenty years ago it was believed there were biotic and abiotic radiations and the differentiation between these wavelengths was in the line of 2910 A.U., which is the shortest wavelength of sunlight to reach the earth. All ultraviolet light was then called near and far ultraviolet light, depending upon to which side of this line reference was being made. Experience since that time has shown that this differentiation is fallacious. If there are abiotic or lethal radiations, ultraviolet light at some time should have caused scarring due to real lethal destruc-

tion of the skin. Scarring, however, has never been reported after ultraviolet applications, no matter how strong. Erythema from a wavelength shorter than 2910 A.U. occurs much more quickly than with sunlight. This can be attributed to the fact that the source of energy is a great deal nearer and because the wavelengths are shorter. According to the quantum theory, the shorter the wavelength used, the more quanta of energy will be delivered in a given length of time.

It has always seemed reasonable to believe that there is no specificity in wavelength. Longer wavelengths only require proportionately more time to accomplish the same result as shorter ones. As an example, vitamin D is being produced in foods with wavelengths in the band of infra-red radiation, but of course much longer time of exposure is necessary than if ultraviolet wavelengths are used. I believe it is preposterous to suppose that any wavelength of light which can not be seen has mysterious physical qualities over those which can be seen. Our retinas are sensitive to the reflection of a certain small band of radiations when they are stopped and that is an infinitesimally small band in the whole spectrum. It is therefore presupposing too much to draw a line anywhere in the radiant spectrum and claim certain actions from this side of the band and certain ones from the other side.

There has been much discussion recently of the bactericidal power of ultraviolet radiation. As far as I have seen in the literature, there have been no well controlled experiments done on a sufficiently large series of cases to support the conclusion that ultraviolet energy is bactericidal *in vivo*.

In research on a large number of patients at the Columbia-Presbyterian Medical Center, we considered that a probable reason why ultraviolet helps skin infections was that it stimulates the resistance of the skin to the sensitizing action of the organisms causing the infection. I have reported cases of erysipelas in which it was possible to cover a portion of the lesion with cardboard before irradiation and not have an extension of the infected margin the next day. Larger and larger areas were covered until, finally, the entire infected area was hidden and the skin on another part of the body irradiated and the lesion cleared up.

In one case of erysipelas on the forehead of an infant who had an infected scalp, I irradiated the child's buttocks and the erysipelas cleared up. Remember, this is a discussion of the use of ultraviolet *in vivo* — not *in vitro*.

The essayist mentions the accepted use of ultraviolet light in surgical tuberculosis. I think we should expand this phrase and define it to mean that general ultraviolet light baths are helpful in such cases. It is not to be expected that ultraviolet light can penetrate deeply enough to have any effect on the wound. It is, however, helpful in its superficial action upon the walls of tuberculous sinuses.

He quotes some authors to the effect that ultraviolet light will penetrate to the spleen, lung, kidney or liver. This is according to the ideas about ultraviolet light held over twenty years ago. Bachem, of Chicago, has shown that it is impossible for ultraviolet energy to penetrate entirely through the true skin. Any possible action on deeper organs, if it can be detected, would be reflex from the counterirritation on the skin.

About sixteen years ago Hutchins, of Syracuse, New York, showed that general ultraviolet baths are the best method of fixing calcium in the blood. He used it a great deal in the treatment of ununited fractures with astounding success. He found that when the blood calcium was below normal, the oral administration of calcium lactate and elixir of iron phosphate, with general baths of ultraviolet, would raise the blood calcium to normal but never above. Also the blood calcium would stay at its normal level for many weeks after treatment was stopped. This was in contradistinction to the action of parathyroid which also fixes calcium in the blood and makes it possible to increase the blood calcium to normal, but when the parathyroid is stopped, the blood calcium immediately drops to its lower level.

Hutchins' work on ununited fractures did not receive much if any recognition except in the Aetna Insurance Company, for which he worked. I used his technic on a series of six cases for the late Dr. Joseph A. Blake, and was able to make fractures unite that had resisted ordinary treatment for two to three years. These cases were all surgical fractures.

Tanning of the skin always has been recognized as a benevolent reaction when patients were given a series of ultraviolet baths. The deposition of melanin in the skin decreases the amount of energy that is reflected from the white skin and therefore more energy is absorbed and a better reaction is obtained. Sometimes ultraviolet is used only as a counterirritant. In England strong erythema doses are given for painful joints merely for counterirritation which lasts as long as the erythema persists.

It is interesting to note that when ultraviolet light is passed through an ultraviolet filter so that only the invisible wavelengths from a mercury arc lamp are emitted, it will not cause conjunctivitis or inflammation of the cornea. This was described years ago by Bucky, of New York.

Such pure ultraviolet passed through a filter has a very important clinical use not generally known. These observations were confirmed by me at the Columbia-Presbyterian Medical Center. Before treating an area with the x-ray, it is a wise precaution to examine the region under an ultraviolet light with an ultraviolet filter in a dark room for possible burns from previous treatments. These invisible scars of burns absorb the ultraviolet light passed through this ultraviolet filter and the burns can be easily detected with the naked eye, while normal skin reflects some of it back. I do not know if this procedure is still

used at the Columbia-Presbyterian Medical Center, but when I last looked around in the x-ray department there was a water-cooled ultraviolet lamp with an ultraviolet filter in a dark room for this purpose.

Bucky states that the evidence of burn is never removed. He has some on his arm that he received over 25 years ago. A similar examination of the skin can be made to see where a strong erythema dose of ultraviolet light has been given. This was described by me some years ago as a means of identification in obstetrical hospitals. A mother's initials "branded" with a stencil on a baby at the time of delivery by means of ultraviolet light, will remain on the skin for over a year and will show up under "black light," although they are invisible in ordinary light.

Concerning the treatment of secondary anemias, for which ultraviolet has always been famous, the essayist mentions that daily doses should be given. This is contrary to usual practice, because it has been found that treatments every other day have a better metabolic effect, as the body then has a chance to redeposit chemicals which are affected in the skin by radiation. Sir Leonard Hill, of London, has always maintained that ultraviolet energy did not affect cholesterol in the skin as was claimed by the late Alfred Hess of New York, but that the effect was oxidation of histidine which is present in normal skin, forming histamine. This histamine absorbed by the superficial capillaries gets into the blood stream and brings about the metabolic effect.

Speaking of metabolic effects, at the old Presbyterian Hospital in New York, I was able to make observations on 100 healthy nurses who received ultraviolet baths to determine what effect there was on ovarian function. Most of the cases who had dysmenorrhea from no known anatomic cause, obtained relief, while many who never had had dysmenorrhea, acquired it. Inasmuch as the observation of these cases showed definitely that there is some effect on ovarian function, although no definite conclusions could be formed, it has always been the custom not to give ultraviolet baths to women during the menses.

The essayist speaks of the effects of ultraviolet light being due to a protein shock reaction. This I very strongly doubt. In arriving at an appropriate massive dose of ultraviolet light in the treatment of erysipelas in three years of research, I gradually increased the dose, thinking that perhaps results were due to a protein shock reaction. No such reaction occurred even when twenty-five times the erythema dose was given, which is a sufficiently massive dose to wipe out erysipelas in most cases in one treatment.

Starr at Long Island College Hospital treating erysipelas in the newborn and infants under two years of age, gave these children as much as 110 times the erythema dose without any evidence of protein shock reaction. It seems improbable that this is the manner in which constitutional effects are brought about by ultraviolet energy. It appears to me that the only chemical

action we can attribute to ultraviolet energy must be classed as oxidation, and that alone. Investigation of a large series of erysipelas cases leads to the conclusion that the premise previously mentioned (increasing the resistance of the tissues to the sensitizing action of bacteria) may be one way in which skin infections are controlled. It seems more probable, however, from the fact that doses can be given in remote portions of the body, that ultraviolet energy when given in sufficiently large doses to cause edema of the skin, has the ability to activate specific immunity. Working along these lines one of the physicians associated with me for two years in ultraviolet research, had the opportunity to utilize this possible reaction in a case of bacterial eczema that was resistant to vaccine and other kinds of therapy. At my suggestion he created two large blisters on the patient's thigh with the water-cooled ultraviolet lamp. The serum from these blisters was removed by a sterile syringe and immediately injected into the patient. Within 48 hours the entire eczematous condition cleared up. I mention this as bearing out the idea that ultraviolet-created edema of the skin helps the body to form specific antibodies. I hope that some of you in this audience, who have opportunity for clinical work, will attempt to confirm this observation and will treat systemic infections with autoserum created in the patient's own skin by blister doses of ultraviolet light.

**Dr. Frank H. Krusen** (closing): I am rather confused by some of Dr. Titus' statements. He mentioned that he produces blisters with ultraviolet radiation, yet he questions the lethal effect of ultraviolet rays. One cannot produce a blister without producing a lethal effect on the tissue cells, so that it would follow that there is a very definite lethal effect of ultraviolet irradiation on tissue cells. Desquamation, which is a common result

of sunburn and blistering, is a lethal action which is widely recognized.

Concerning bactericidal effect *in vivo*, Dr. Titus says he has never seen bactericidal effects result from irradiation. Repeatedly, bactericidal effects have been disclosed as resulting from ultraviolet irradiation, and the experiment is so common that the effects of it are taken for granted. The destruction of bacteria on the surface of the skin, which is an *in vivo* effect, is likewise to be expected from ultraviolet irradiation. It is true that ultraviolet rays penetrate almost not at all or to a depth of about 1 mm. at most (possibly only a fraction of a millimeter), and it is true that there are no direct deep effects of such irradiation. The work to which I referred concerning changes in the lungs, liver and other organs, indicated that these changes were results of photochemical effects. Dr. Titus chooses to believe that they are reflex in nature. Each investigator is permitted to exercise his own choice, and none of us is certain.

Concerning the statement of Leonard Hill that ultraviolet irradiation has no effect on cholesterol, I think one need only refer to the recent work of Harris at the Massachusetts Institute of Technology to conclude that his studies definitely indicate the activation of eleidin (7-dehydrocholesterol), and I don't think there is any doubt as to the authenticity of this excellent study.

There are a number of aspects of ultraviolet irradiation and its effects which are controversial in nature, and I believe I have repeatedly pointed out that there is much to be learned about ultraviolet irradiation and its effects on the human economy. Until we learn more about the subject, it is probable that we must expect argumentation and minor differences of opinion, but I believe everyone really enjoys such arguments.



## USE OF THE THERMOPHORE FOR DETACHMENT OF THE RETINA \*

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When one considers the delicate connections between the retina and the underlying choroid it seems remarkable that separation between these two structures does not occur more frequently. The causes of detachment of the retina are trauma, which may be directed to the eye, or caused by a sudden jarring or jerking of the head, or may be initiated by myopia with stretching of the globe and results in separation of the retina. It may follow such disease as choroiditis with serous exudate, tumors and traction on the retina by organized bands following intraocular disease.

From this it becomes clear that the treatment of necessity varies. Since the great majority of intraocular tumors are malignant, the only safe method here is prompt removal of the globe with as much as possible of the optic nerve. Inflammatory conditions must be overcome before the detached retina can be handled properly.

Traumatic and such other detachments occurring from myopia are the ones to be handled by operative means, and experience shows that surgical intervention is the only method of restoring such eyes to usefulness. It would seem that any measure which will evacuate the sub-retinal fluid present in retinal detachment, and bring about a choroidal exudate that will "spot-weld" the retina to the choroid, can give the desired result.

For many years retinal detachment was viewed with such pessimism that but little effort was made to bring about recovery in such cases until Gonin demonstrated its possibility.

Gonin based his method on the idea that all retinal detachments started with a tear in this organ. The liquified vitreous burrows into the sub-retinal space and separates the retina from the underlying choroid. He directed his treatment towards closing the tear in the retina and thereby preventing further entrance of the vitreous substance behind it. This was done with a cautery puncture at the site of the tear after a very accurate localization. The percentage of cures was about 33 but in this country very few ophthalmologists could even approximate this result by a similar method.

Guist advocated multiple openings through the sclera to the base of the choroid without going through the latter until the last one or two applications of the trephine. This was to prevent the globe from becoming too soft or even collapsing during the operation. The choroid exposed through these scleral trephine holes was then touched with potassium hydroxide, to bring about a chemical stimulation of choroidal exudate. This was not generally satisfactory and other methods were tried, among which were perforation of the sclera with multiple electrified needles that produced the exudate, or by multiple punctures with a single needle. The first of these methods was used by Walker, whose technic was preferred by Safar and Gradle.

### The Thermophore

There have been several other workers who have used external heat applications to the sclera, usually in the form of diathermy. In 1934, the

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idea of using the thermophore as an irritating source led to the first operation for separation of the retina. When Shaban first introduced the thermophore for the treatment of infected ulcers of the cornea, both he and Post made a thorough study of its effect on eyes at different temperatures. After an application of one minute at a temperature of 160 F., they observed on the following day a resulting choroidal exudate and a very friable sclera. In twenty-four hours the sclera had returned to normal and with a gradual disappearance of the exudate, there were left some areas of choroidal degeneration.

The two things necessary in replacing a detachment of the retina are first, complete evacuation of the sub-retinal fluid and second, the production of enough exudate to cause adhesions between the retina and the underlying choroid. An operating technic as simple as possible is very desirable, since many cases of retinal detachment occur in locations too far from metropolitan centers prepared to cope with such operation but which would have a chance for improvement if they could be properly managed by the local ophthalmologist. The thermophore is familiar to all well-trained ophthalmologists and the method of its use for retinal detachment is one which is easily controlled. It creates a definite reaction for the formation of exudate, and its use for this purpose should be possible for any one accustomed to routine ophthalmic surgery.

#### Technic of Operation

The operation is done under a local analgesia, after routine preparation similar to that used for cataract extraction. The area involved is first carefully studied, satisfactorily outlined if and when a tear is present and located as accurately as possible.

The conjunctiva over the entire area is elevated, the sub-retinal fluid is evacuated through one or more scleral punctures with a Graefe knife, and applications of the thermophore with a curved tip at 160 degrees are made over the area. Each application is one minute in duration. The number of applications should be enough to cover the involved area and especially to cover the area of the tear if one has been located. In many cases no tear will be seen, since if one is present it may be too far forward for it to be discovered. I have never found it necessary to separate an extraocular muscle, feeling that it is sufficient to displace it with a strabismus hook.

After the operation the patient is kept in bed with sand bags on each side of the head for two weeks with both eyes bandaged. After two weeks the head of the bed may be gradually elevated and stenopaëic goggles, the opening of which is 1 by 3 mms., used.

The motions of the patient are restricted for another ten days or two weeks and then his activities are gradually increased, the stenopaëic goggles still being worn. He is advised to restrict the use of his eyes for at least another month and especially to avoid all physical exercise for that period.

Some surgeons advocate using the thermophore applications before the scleral incisions, feeling that the globe will be more rigid for this form of treatment and that the retina will be less likely to be damaged in this way. Neither of these reasons seems to me to be sound. With the thermophore one does not have to pierce the sclera, but rather to make contact with the globe, and this could be done if it were completely collapsed. So far as damaging the retina is concerned it seems obvious that some damage must be done in order to anneal it to the choroid by the exudate.



Post in discussing this subject at the recent session of the American Medical Association felt that the scleral puncture and the removal of the sub-retinal fluid before making the thermophore applications was a distinct advantage, because with a soft globe it is easier to reach the posterior portions of the detachment. An added advantage in making the earlier scleral punctures is that the pressure on the globe produces further evacuation of the sub-retinal fluid, and unless this is thoroughly done success is unlikely.

The old form of the thermophore was very awkward to use. Its square shoulders made it difficult to keep it from contact with adjacent structures and rendered it laborious to get it in connection with the posterior portion of the globe. Shahan's latest model is a great improvement. It is light and readily handled. He has a very satisfactory tip especially for this work, and its sloping shoulders enable the operator to handle it with ease.

Of the other methods, the electric puncture is used by Verhoeff, Safar, Gradle and Walker, all with the same basic background, seeking to produce exudate by perforation with needles and stimulation of choroidal exudate by the current which they carry.

Peter prefers the Walker method as did Dunnington and Macnie until they changed to the Lacarrere.

Benedict at the Mayo Clinic, finds the Safar or Gradle needles the most satisfactory method. Berens in reporting cases from New York Eye and Ear Infirmary, stated that the choice of methods was diathermy alone or combined with trephine or electrolysis. Ellett has used various methods, sclera cautery, ignipuncture, injection of mercuric cyanide, diathermy and sclerotomy.

### Clinical Progress

A word as to cure in retinal detachment. I think that the suggestions made by Post and Sanders in their article are very sound. They feel that complete reattachment is necessary in order to record a success. With complete reattachment, visual improvement should occur especially with regard to the peripheral field, which will probably regain all its function. Should the detachment have existed for more than three weeks, central vision will not return to normal owing to cystoid degeneration of the macula. Even though complete replacement has occurred, redetachment is so probable that cases should be under observation for some time before they are called a definite cure. Post and Sanders have suggested a year as a reasonable period of observing the progress of the patient.

Where there has been an inflammatory condition preceding the detachment, the results are not likely to be good results. Such patients would possibly do as well if the operation were not performed. The longer the detachment has existed, the less good will be the result, so that after six months, operation is probably a wasted effort, the only hope being that further deterioration and complete destruction of the eye may be prevented.

Dunnington and Macnie reported a cure of 42.1 per cent, an improvement in 8.2; failure in 49.7 per cent.

Benedict reported success in 49 and failure in 51 per cent.

Berens reported an improvement, in vision, nine months after operation in 21 per cent of his patients. However, he reports complete reattachment in about 36 per cent of 185 eyes operated.

Ellett reports total reattachment in 23 per cent of his cases. Full return of the visual field was noticed in 22 per cent and improved central vision in 30 per cent.

Post and Sanders reported the following:

Multiple scleral diathermy, 35 per cent successful.  
Scleral diathermy using Walker pins, 43 per cent successful.  
Scleral diathermy with galvanic current, 25 per cent successful.  
Thermophore, 78 per cent successful.  
Thermophore and scleral diathermy, 00 per cent successful.

### Discussion

Summing up the cases which have been operated by various authorities, it is noted that 9 were reported by Post and Sanders with 7 cured, or 78 per cent. My own experience includes 18 patients of whom 11 were cured, or 62 per cent; Clapp when discussing my paper last year before the American Medical Association in June, presented 8 cured cases, or 100 per cent. In the same session another discussor, Harold F. Wahlman, reported 10 cases with 7 cured, or 68 per cent, making a total of 45 cases operated on in this manner with 26 cured or total of 70 per cent. There have been patients also operated on by Drs. Griscom, Cohen and Shannon of Philadelphia, but to date none have reported their results. One case of Dr. Griscom's is of special interest. One eye of the patient had been operated on for detachment of the retina by the Safar method two years before and there had been a re-detachment. The second eye suffered a detached retina and was operated on with the thermophore with a most satisfactory result. The last report of the patient was eighteen months after the operation. The statistics based on such a small number of cases are, of course, far from conclusive, but I think they are sufficient to show that this method of dealing with detachment of the retina has enough merit to justify further consideration.

In handling a case of detachment of the retina it is necessary (1) accurately to outline the area of the detachment and locate a tear if present; (2) completely to evacuate the sub-retinal fluid; (3) to apply the thermophore at a temperature of 160 F. and this in sufficient number to cover the involved area, especially in the region of the tear. The applications should be about 4 to 5 millimeters apart and each for a duration of one minute; (4) complete immobility of the head for two weeks is essential. The position of the body may be changed by the adjustment of the surgical bed, and the early discomfort may be relieved by massage of the muscles of the back and shoulders with the head kept in as quiet a position as is possible; (5) continued restriction both as to bodily motions and ocular use for a time sufficient to allow complete organization of the choroidal exudate is of greatest importance.

### Discussion

**Dr. Oscar B. Nugent** (Chicago): I wish to congratulate Dr. Langdon on his thorough and excellent paper and especially upon the high percentage of recoveries following his method of treatment. It is indeed a real problem to determine either from the literature or from one's own experience which of the several types of operations which have been described, is the one giving the best results. It is my opinion that all does not depend upon the type of operation employed in any given series of cases, but that much depends upon the thoroughness of the operation and the after care. The individual case is a big factor, for as Dr. Langdon has stated, "After six months, operation is probably a wasted effort." Much de-

pends upon the pathologic process present at time of operation.

The advantages which may be attributed to the thermophore is its simplicity of technic. The fact that tissue destruction is not so great as in the coagulation method, may also be a factor in its favor. As has previously been stated, the most favorable cases are those in which the tear has been found and exactly located; recent detachment; small detachment, and those due to traumatism. Those given less encouraging results are cases in which the tears cannot be easily located, usually because of opacities in the vitreous; absence of tears; complete detachment; serious complications following accident or illness, and those of very long duration.

I wish to repeat a paragraph of a paper read before this body two years ago—"Whatever may be said for or against the various operative procedures thus far devised, the credit for the origin of the modern procedure must go to the late Professor Gonin, notwithstanding the fact that the procedure which he practiced and described, and which was the technic used by all the earlier operators, is now virtually obsolete. It is upon his idea of closure of the hole in the retina, and of furthering the production of adhesive chorio-retinitis, that the present day procedure is based. Vastly different from the Gonin technic though our modern procedure is, it still carries on the original thought."

**Dr. A. D. Ruedemann (Cleveland):** I think that Dr. Langdon is to be complimented on the work being done on a new or another method for getting retinal reattachments. To be sure, I have tried all the old ones and will now try the diathermy method. The only reason I haven't tried it heretofore is that to me it was apparently not a logical operation for the simple reason that the first thing we must do is get rid of the sub-retinal fluid and produce adhesive choroiditis. We all know that profuse heat will produce local areas of edema far outside of the amount of destruction produced by the single needle or the small lake wire needles.

Our experience with the other forms of diathermy for retinal detachments have been very unsatisfactory. I believe when all the cases are reported, after a period of a year or more that they all will be unsatisfactory. I cannot quite accept that anyone, and certainly not we, has ever had a success approaching 70 per cent. We have now up to some 200 odd cases of retinal detachment. They were performed by the Graefe knife and we have used the Whist method, and all types of cautery. Our visual results are probably in the neighborhood of 20 per cent and our reattachments reach about 39 per cent. The reattachment of the retina is much higher than the visual result and if anything in the future should offer a better visual result, I am perfectly willing to try it.

I think Dr. Langdon is presenting a new procedure with better visual results than we have obtained, and is to be complimented. However, I have an element of doubt in my mind in regard to adhesive choroiditis produced by the Shahan thermophore. I think a great deal depends on the retinal drainage. A number of our cases, especially those of traumatic detachment can be benefited by excising it clear and drawing off the sub-retinal edema in time for the retina to fall back in place and become adherent.

The tissue fluids themselves will produce an adhesive choroiditis and in those that have an exudate of choroiditis with the retinal detachment in which the retina is pushed off with sufficient fluid. If the retina is allowed to fall back into posi-

tion I think that in itself will produce a reattachment. I remember very distinctly in the first two cases of traumatic detachment I used a Graefe knife, drew off the edema, and the eye went back into position and was perfect afterward. It was as serious a detachment as I have seen. We all know the best results are obtained from those who have merely edema in the retina. Those who have serious degeneration of the vitreous do not get good results and unless we select our cases very carefully we are apt to find that we will be operating on all patients with retinal detachments and get the end results we have experienced in our organization. The reason for that is that we take on anybody who has a retinal detachment. We do not select our cases very carefully. If they are young enough and will hold still long enough, we will operate on them. There is a good reason for it. Three years ago I had a man come in who had a bilateral retinal detachment, a vitreous degeneration and complete blindness as far as economic use of his eyes was concerned. There was nothing to do except to obtain reattachment. We used a diathermy cautery to both eyes at the same time, practically 60 per cent of each eye, and he has complete reattachment in one and a third in the other eye, which means economic provision. It would be absolutely a case one would reject because with the selective method of choosing cases, he should not have been operated. For that reason I think they should all be given an opportunity.

**Dr. H. Maxwell Langdon (closing):** I was very glad to hear the tribute that Dr. Nugent paid to Gonin because I think he is the cornerstone and the impetus of all our modern work on detachment of the retina. As I said in my report, I felt that we were sunk in deep nihilism for we were wont to give patients sodium iodide mixed with some scleral punctures. For Dr. Ruedemann's benefit I wish to mention an interesting case that dates back 20 years. I had one patient who lost one eye, while the other had a partial detachment. I kept her in bed for three months. I don't know how many scleral punctures I did, perhaps 20 or 25 altogether. She got a complete result, so that 15 or 19 years after she was using the eye continuously.

The simplicity of the procedure which I mentioned and which Dr. Nugent commented on, really is the main feature of the thermophore. Other measures will accomplish the same results, but they need a complicated apparatus and a man with a large operating clinic who is operating all the time. And as I stated in a paper before the American Medical Association in June, a lot of these cases are clear in the backwoods where there isn't a modern, well-trained ophthalmologist. They could use a thermophore because it is not difficult. What one should do is be careful and thorough and be sure to get all the sub-retinal fluid out.

## PRESENT STATUS OF RADIATION THERAPY IN NASAL SINUSITIS \*

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The success of x-ray therapy in certain inflammatory processes stimulated its trial in refractory cases of nasal sinusitis as early as 1916. In 1923, Osmond<sup>1</sup> described excellent results in twelve acute cases, but its value in subacute and chronic sinusitis was generally overlooked until 1930, when the first report of Butler and Woolley<sup>2</sup> was published. When these authors<sup>3</sup> published, in 1934, their clinical results in seven hundred cases and also their findings in animal experiments, it became generally recognized that a major advance had been made in physical therapy. Since then numerous other authoritative reports have become available and the indications, contraindications, and rationale of x-ray therapy in sinusitis have been firmly established.

Laboratory studies by Larsell and Fenton<sup>4</sup> have shown the effect of x-ray treatment to be due primarily to early destruction of lymphocytes in the infected sinus membranes with consequent release of their beneficial antibodies, enzymes, and other protective substances. A heavier infiltration of macrophages and histocytes is stimulated, resulting in a more rapid phagocytosis. The diseased membranes become thinner but retain some plasma cells and leukocytes, followed later by a mild fibrosis. The ciliated epithelium and other normal structures are not injured and there is no damage to the underlying organs.

Different types of sinusitis vary markedly in their response to radiation; and to obtain best results cases must be selected with care. In any event, every case of sinusitis or suspected sinusitis merits a careful examination by an otolaryngologist who is best able to classify the type of affection present and to attempt a cure by the usual conservative measures. If such methods as inhalation, packing, suction and irrigation prove ineffective, a trial of radiation should be seriously considered before resorting to radical measures. When surgery is considered to be absolutely necessary, it is often of value to apply x-rays before or after the operative procedure.

In considering the selection of cases, and the results which can be expected in various types of cases, it is helpful to divide sinus disease into five classifications:

1. *Acute Sinusitis.* — The majority of these cases usually clears up promptly under conservative therapy; and radiation is therefore not routinely recommended. However, in pansinusitis, or in cases where antral puncture is refused, radiation will often hasten convalescence if small doses are employed after careful shrinkage of the nasal mucosa. Ordinarily, radiation should not be applied over an antrum full of pus until some form of drainage is established.

2. *Subacute Sinusitis.* — These cases often respond poorly to the usual methods of treatment due to the presence of thickened mucous membranes in addition to an exudate. The thickened membranes are ordinarily demonstrable on x-ray films even after careful irrigations. The involved tissues are highly radiosensitive due to the presence of a large number of lym-

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phocytes, and can be effectively shrunk by x-ray therapy. Of all types of nasal sinusitis the best results are obtained in this group. This is particularly significant in the view of the fact that these cases tend to become chronically infected if not effectively treated.

3. *Chronic Sinusitis with Hyperplastic Membranes or Early Polyp Formation.*—These are cases which originally have been inadequately treated or have failed to apply for treatment until relatively late. The thickened membranes are quite heavily infiltrated with lymphocytes and usually almost as radio-sensitive as in the subacute types. Good results can therefore be expected by radiation although they may not be rapid or dramatic. The early polyps respond fairly satisfactorily, but require slightly larger doses of radiation than are otherwise employed.

4. *Chronic Sinusitis with Extensive Scar Tissue or Polyp Formation.*—In these cases there is relatively little cellular infiltration and only fair results can be expected. Moderate symptomatic relief can be obtained, however, and occasionally surprisingly complete eradication of the disease is effected.

5. *Atrophic Sinusitis.*—In this group no benefit is obtainable by radiation. Sinus disease in children constitutes a large problem in itself. Children respond less satisfactorily than adults to the usual methods of treatment and are more apt to develop complications such as otitis media, mastoiditis, bronchitis and bronchiectasis. In a large percentage of cases there is a history of repeated and prolonged upper respiratory infections with severe coughing bouts. In many there is evidence of enlarged adenoids or hyperplastic lymphoid tissue throughout the pharynx, conditions definitely known to be benefited by radiation. Rathbone<sup>5</sup> has studied an unusually large group of cases of childhood sinusitis and reported excellent results by radiation, particularly for the prevention of complications.

In the general field of sinus irradiation, strikingly consistent results have been reported by outstanding workers. Stevens,<sup>6</sup> Smith and Nickel,<sup>7</sup> Rathbone, Butler and Woolley, Bernheimer,<sup>8</sup> and Warren<sup>9</sup> all report cures or very marked improvement in at least 80 per cent of properly selected cases. This is particularly interesting when compared to the uniformity of reports expressing dissatisfaction with radical sinus surgery during the past seven years by such otolaryngologists as Hilding,<sup>10</sup> Jervey,<sup>11</sup> Hays,<sup>12</sup> Snow,<sup>13</sup> Buckley<sup>14</sup> and Salinger.<sup>15</sup>

Although sinusitis is relatively uncommon among natives of Florida, we see numerous cases in our transient population. Our results with radiation in the chronic hyperplastic and subacute forms have been highly satisfactory, but the most striking benefits have been observed in children and adolescents. The following case is typical:

H. J., aged 8, a dentist's son, presented a pansinusitis with a history of dozens of upper respiratory infections each year, a constant postnasal drip, and chronic cough which resisted the usual forms of therapy. Following four treatments given over a period of two weeks, the cough and drainage disappeared, no more upper respiratory infections occurred and his general health improved remarkably. Follow-up x-ray films showed the sinuses to have cleared completely.

The exact technic of x-ray therapy is of interest only to radiologists and need not be discussed here in detail. In general, the most commonly recommended method is the application of small divided doses of intermediate or high voltage radiation over a period of several weeks. A few authors recommend that a relatively large amount of radiation be given in a single treatment, but the smaller divided doses appear to produce equally good results and can more safely be repeated in the event of a recurrence.



### Summary

1. Extensive clinical and laboratory studies have proved the value and established the rationale of x-ray therapy in nasal sinusitis.
2. Different forms of sinus disease vary in their response to radiation and to obtain best results cases must be selected with care.
3. The most outstanding results have been obtained in the subacute and chronic hyperplastic forms of sinusitis.
4. The method is particularly valuable in treating children and infants.
5. Interest in radiation is growing as the enthusiasm for radical surgery continues to wane.
6. All cases treated by radiation should have the benefit of rhinologic consultation and observation.

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(For discussions, see page 222)



# PRINCIPLES OF RADIATION THERAPY OF HEAD AND NECK NEOPLASMS \*

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The purpose of this paper is to emphasize the importance of the correlation of the physical factors and the biologic effects of radiation therapy. While it is believed that the ideal methods of treatment have not yet been attained, a more rational therapy has gradually been evolved during the past decade. There has been a standardization of roentgen ray machines and radium applicators, and tables are now available to show the variation in quality and quantity of the radiations by changing the kilovoltage, filter, field, distance, milliamperage and time.

The radiologist should be familiar with the air dose, skin dose and tumor dose, and is urged to note all factors in recording treatments. The best method of radiation is one that causes complete regression of a malignant tumor with the least damage to the surrounding tissues. Pathologists are familiar with the biologic response of various tumors to irradiation, and have been able to suggest in many instances the indications and contraindications to treatment.

I should like briefly to outline the technic of radiation therapy in a few types of head and neck tumors, and give the reasons for such procedures.

## Epidermoid Carcinoma of the Face

While several satisfactory methods for the treatment of skin cancer are approved, that of low voltage x-rays unfiltered, or lightly filtered, is considered the most useful. It is possible to deliver 6000 to 9000 r to a small lesion one centimeter in diameter, or 3500 to 4000 r, equivalent to twelve to fifteen erythema doses, to a lesion five centimeters in diameter, in order to bring about complete regression. The intensity of the radiation in the skin and immediately below it is in contrast to the relatively high depth dose that would be delivered by hard penetrating rays. The measurements in one of the standard 50 kv. low voltage machines gives a depth dose of 46 per cent at 0.5 cm., 22 per cent at 1.0 cm. and only 8 per cent at 2.0 cm. If a 200 kv. machine is used at 50 cm. focal distance, 0.5 mm. of copper filtration, and applied to a five square centimeter field, the depth dose is 95 per cent at one cm., 63 per cent at three, and 43 per cent at five cm.

It is well known that the Threshold Erythema Dose also varies with the quality of radiation. For example, with 50 kv. the T.E.D. is 115 r; 100 kv. the T.E.D. is 270 r; 140 kv. the T.E.D. is 525 r; 200 kv. the T.E.D. is 680 r; 700 kv. the T.E.D. is 800 r. The threshold erythema dose for gamma radiation is 1000 r.

Basal celled carcinoma responds more easily to radiation than the squamous type. There is a tendency toward surgical removal of squamous celled carcinomas of the face, but I believe that equally good results can be obtained by divided doses of x-ray therapy, or interstitial radiation by means of gold radon implants. For example, in a lesion 2 cm. in diameter 675 mc. hr. will give 5 T.E.D.; 1350 mc. hr. will give 10 T.E.D. In some cases the x-ray dose may be supplemented by gold filtered radon implants.

\* Read at the Nineteenth Annual Session of the American Congress of Physical Therapy, Cleveland, Ohio, September 3, 1940.

### Vascular Nevi

The treatment of birthmarks varies according to size and location. Port-wine stains are not amenable to radium therapy, but may be bleached a little by the application of a non-filtered radium plaque. The plaque must be kept moving over the lesion, in order to produce a uniform effect. I have found, however, that the cosmetic preparation "Covermark" offers the most satisfactory treatment.

Elevated or tuberous hemangiomas are radium sensitive, and excellent results are obtained by divided doses. If the lesion is small or not more than one centimeter in diameter, surface application of radium tubes is made. If the hemangiomas are more extensive, radium is applied at one or more centimeters distance, or interstitial treatment by means of platinum radium needles, or gold radon implants is administered.

In one patient, a girl 17 years of age, with an extensive cavernous hemangioma of the hard palate, divided doses of gold radon implants 1.5 mc. each were used. Surface radium treatments or excessive interstitial dosage at one time would probably have caused ulceration and severe hemorrhage. Radium has a more selective effect than x-rays on the endothelial cells lining the vessels that compose the angiomatous process. Uniformly good results should be obtained if care is taken not to produce too much damage to the skin and surrounding structures.

### Sinusitis

Since there are frequent recurrences following removal of nasal polyps, radium and other physical agents have been used postoperatively with considerable benefit. The radiation treatment consists of the application of a standard 50 mg. radium tube screened with 0.5 mm. of platinum applied with proper packing to each ethmoid area for three to four hours, giving approximately two T.E.D. On an average four treatments are given at ten days to two weeks intervals. It is noted that after radium treatments fewer polyps recur and these are more fibrous in character. The interval between recurrences is lengthened and the nasal discharge is diminished. Since destructive doses are not given, the above technic illustrates the well known effect of "growth restraint."

In certain cases of chronic maxillary sinusitis with greatly thickened mucosa with lymphocytic infiltration, small doses of x-rays have proved beneficial. The importance of adequate drainage must be emphasized and can usually be obtained by an intra-nasal opening. Since the trend is to conservative surgery in sinus disease, radiation will probably play a greater part in the future.

Malignant tumors of the nasal sinuses are best treated by a combination of surgery and irradiation. Preliminary x-ray therapy in divided doses through small ports to the anterior cheek, lateral cheek and intra-oral areas is given. The amount of treatment varies with the individual case, but an average of 3000 r may be applied to each area, using 200 kv. at 50 cm. focal distance and 0.5 mm. copper filtration. Following the x-ray therapy a Caldwell-Luc operation is performed, in order to remove the tumor and establish drainage. At the time of operation, or within a week afterward, radium tubes are applied to the antral cavity. I have used two 50 mg. radium capsules for 24 to 36 hours and repeated the dose after a few weeks, if a residual tumor was found to be present.

### Carcinoma of the Tongue and Tonsil

Most malignant tumors of the tongue and tonsil are treated by x-ray and radium. Small localized accessible lesions may be removed surgically, but the majority of cases are inoperable when first seen.

The present day treatment is fractionated doses of x-rays directed through

small ports followed by an additional treatment with radium needles or gold radon implants.

X-ray treatments may be given daily or every other day with 200 to 300 r per dose until the maximum skin tolerance total dose of 4500 to 6000 r is reached. Large fields of radiation are not advisable because of the great amount of back scatter. The interstitial dose of radium is not great after the external radiation has been given, but is usually necessary in order to deliver a lethal dose to the resistant carcinoma. Gold radon implants 1.0 to 1.5 mc. are imbedded in each cubic centimeter of tumor tissue that remains after the external radiation has been administered.

### Summary

1. The radiologist should be thoroughly acquainted with the physical factors of x-ray and radium in order to make the proper application to the various tumors of the head and neck.

2. The pathology of tumors deserves study by the radiologist so that a rational plan of therapy may be outlined.

3. The use of x-ray and radium in skin cancer, birthmarks, sinusitis and malignant tumors of the antrum, tongue and tonsil have been discussed.

40 East 61st Street.

### Discussions of Papers by Drs. A. G. Levin, and G. Allen Robinson

**Dr. J. D. Osmond** (Cleveland): I agree with Dr. Portmann's method of obtaining beneficial results in inflammatory conditions about the eyes, the cervical, salivary and tuberculous glands of the neck. The most dramatic results have been obtained in the treatment of tuberculous cervical glands. I have not treated papilloma of the larynx but would expect benefit if the growth is small.

He mentioned otitis media. We had one remarkable case in a man who had otitis for about three months. He was not working because of a slight rise in temperature. He was quite deaf, and his physician sent him for treatment to me, to see if we could help him. We treated each mastoid and also an accompanying sinusitis. The patient promptly got better and within two weeks was back at his usual work.

In regard to Dr. Robinson's essay, we lean on support of the pathologist regarding the sensitivity of malignant tumors. However, we are often requested to do as much as possible for the patient, even though the prognosis is not favorable. We do what we can and share the blame. That is about what it amounts to. However, we attempt to prolong the patient's life and make him more comfortable.

As regards nevi, I think the best time to treat this condition is as soon as it is detected. It enlarges rapidly and should be cared for within the first few weeks of life, if possible. Radium gives good results, but we prefer the unfiltered roentgen ray, giving about 150 r and if that doesn't control it, we give two radiations.

In regard to Dr. Dixon's paper, our experience is about the same as his. I do not expect more than 50 per cent improvement by roentgenotherapy of allergic rhinitis and I think that depends largely on how much sinusitis is associated with allergic rhinitis.

Regarding Dr. Levin's paper, we have used roentgen therapy in nasal sinusitis since 1916. Our results in the past were usually good. Since the first report in 1922, we have always used small doses of roentgen ray. Now if you will review the literature you will find some using 200 kv. and some 120 to 150 kv. We have always treated with the lower kv. level. There may not be much difference in the immediate results, but if the condition is acute or subacute, certainly it doesn't need a high kv. for definite effect. All one wants is to stop the acute swelling of the mucosa, and stimulating the leukocytes in defense and that one obtains very promptly with the lower voltage.

**Dr. Roswell Lowry** (Cleveland): It is quite gratifying as a general practitioner, to know the many efforts being made to perfect the conservative methods of treatment of nose and throat conditions since the radical proceedings have left so much to be desired in the past. It is with extreme interest that I note the essayists clinging to a center-of-the-road course, stressing the necessity of trying the simple but fundamental procedures that have been thoroughly tried and proved, before employing radiation, and also in conjunction with radiation therapy. It brings home the fact that no longer do we stress the condition being treated, but the patient's individual morphologic and physiologic structure and reaction.

In connection with this middle-of-the-road attitude, I should like to suggest that some of the physical modalities at our command be included in the armamentarium of the physician treating these conditions. The production of heat by infra-red and diathermy is beneficial as an adjunct to the general measures. Close cooperation between our nose and throat department and the department of physical therapy has al-

lowed us to treat a good many cases of sinus disease that I wish to comment on.

Infra-red radiation, using the tungsten filament incandescent lamp, has proved valuable in acute cases of frontal and maxillary sinusitis, drainage having first been encouraged by vasoconstrictors such as ephedrine. I firmly believe that it is useless to give infra-red treatment at long intervals. It should be given every three to four hours during the day, if need be at home by the patient himself with an ordinary 100 watt lamp in a reflector, which may be made from any reflecting material.

Short wave diathermy is very valuable in cases of subacute and chronic sinusitis. I prefer the induction coil applied to the sinuses, since it has been shown that the characteristics of the condenser field, using the pad electrodes or air-spaced electrodes, tend to produce excessive heating in fatty tissue, such as abounds in the nerves and brain. Here again I believe that effective treatment can be accomplished only by frequent treatments.

**Dr. Harry Hauser (Cleveland):** That irradiation now has a place in the treatment of inflammatory as well as neoplastic lesions of the eye, ear, nose and throat is beyond question from the evidence presented here today and from that contained in the literature.

Dr. Portmann's extensive experience in radiotherapy makes any of his utterances a matter of serious consideration. I have had experience in treating and observing some of the types of lesions he has mentioned. With the good results I have been fortunate to obtain in the treatment of tuberculous iritis and dacryocystitis, furuncles and chronic dermatitis of the auditory canal and in post-operative parotitis, it would appear that similar results could be obtained in the other inflammatory lesions mentioned by Dr. Portmann. Small, non-harmful doses are the rule.

From our knowledge of the pathologic changes occurring in the paranasal sinuses affected by subacute and chronic inflammatory disease, it is only reasonable to assume that the effects of radiation therapy would be beneficial in the majority of cases. I am in agreement with Dr. Levin's statement that, "the involved tissues are highly radiosensitive due to the large numbers of lymphocytes present and can be effectively shrunk by x-ray therapy."

Most workers in this field agree that the majority of patients with acute sinusitis recover in a short period of time by the use of conservative measures. Those patients who fail to respond to this form of treatment become chronically affected and many of them can be greatly improved, if not cured, when radiation therapy is applied in proper doses.

Since inflammatory sinus disease is a complex problem, it is generally conceded that selection of cases by the combined judgment of the oto-laryngologist and radiologist will avoid errors in the management of the disease. In some instances, surgical procedures will precede roentgen-

therapy, and under different circumstances irradiation will be the first form of therapy. The dosage applied by the radiologist should be dependent upon the diagnosis made by the oto-laryngologist. The two specialists working in close harmony can accomplish more for the patient than either working alone.

Dr. Robinson has covered a large group of subjects in more or less outline form. He has laid down fundamentals of radiation therapy which, in my opinion, are for the most part sound. I am in full agreement with the large doses he advocates in the treatment of carcinomas about the head and neck. Such high total doses of roentgen and radium rays, used singly or in combination, are necessary if satisfactory results are to be obtained in these malignant neoplastic lesions.

In the treatment of cavernous hemangioma, Robinson made the statement that, "radium has a more selective effect, than x-ray on the endothelial cells lining the vessels that compose the angiomatous mass." My experience with roentgen rays has led me to the conclusion that there is no demonstrable difference in the biologic action of the two modalities. I should be pleased to hear the doctor discuss this point further.

Since I have had no experience in the treatment of allergic rhinitis by irradiation, I do not feel too competent to discuss Dr. Dixon's paper. It does seem to me, however, that radiation therapy in this disease affects the symptoms without eradicating the cause and thereby permits its recurrence. Further experience and a longer time interval is needed before we can evaluate the results.

**Dr. H. L. Sinskey (Baltimore):** I would like to ask a question. I have had a number of patients who have sinusitis with allergic rhinitis who state that their condition always becomes worse following treatment. I would like to have one of the essayists answer why they get worse. I wouldn't expect them to. The sensation remains for a long time and the condition would be worse than before they went to have the x-ray treatment.

**Dr. E. E. Poos (Detroit):** I like to class my sinus cases into the acute, which is characterized by an inflammatory reaction, and then, of course, pus. In these cases we have also more or less general disturbances. One of the things, of course, is hyperoxidation. We have an elimination of fluids. The pus is more or less acid. We see a tendency to stimulation of all the sympathetic nervous system. Now if that case isn't cured, it runs into the subacute or chronic stage. The characteristic response there is that of lymphocytic infiltration, which the x-ray helps. Those are the only type of cases in which I have had good results with the x-ray.

**Dr. Fred W. Dixon:** In regard to Dr. Levin's paper, I believe that the rhinologist is in perfect agreement that no acute affection of the antrum should be



treated by x-ray. First, get rid of the pus and then radiation therapy may be indicated. I am sorry Dr. Levin is not here to answer what the effect of radiation therapy is on the old chronic cases where the antrum mucosa is lined and thickened, a polypoid present, and the membrane being a quarter or a half inch thick and degenerated. I wonder whether or not radiation therapy would affect such old chronic mucosa, whether or not one could eradicate the polypoid that might be there under radiation therapy, whether or not it would not be better to do a Caldwell-Luc operation and get rid of the mucosa and then direct radiation therapy to the newly-formed membrane rather than to the old chronic membrane.

The question I would like to ask, from a rhinologist's standpoint is: How do these people that are supposedly cured stand up under their subsequent upper respiratory infections? Do they stay cured?

Recently a roentgenologist told me he had treated 100 cases of sinusitis, with 95 per cent cures. I asked him whether he followed the cases another year or just accepted his patient's word for it, and he admitted his reliance on the patients' statements. There was no x-ray taken afterwards to know whether or not the lining membrane was lessened. That, of course, is what we are interested in.

Rhinologists usually have little difficulty in treating acute cases of sinusitis. It is very seldom we run across a case that does not respond to treatment, that is, the acute, where the patient gets up from the treatment chair and says, "that feels better," or perhaps that pressure is gone, and it is very seldom we see acute cases that come back more than three or four times. Usually they are better after the second treatment. It

would be interesting to follow these cases. That is a thing the rhinologists have trouble with. We can't keep them cured. They get another cold and their infection is likely to light up. I would like to know whether roentgen therapy keeps them cured, because they will catch cold and get an upper respiratory infection regardless of what condition their sinuses are in.

In regard to the question which was asked about the reaction following the x-ray treatment in allergic cases of rhinitis, several of them complained of quite severe reaction after the first treatment, but were relieved after the second treatment. There was none that complained of any great amount of discomfort in a series of 27 patients. I think 3 or 4 said they were uncomfortable after the first treatment. That wasn't continuous.

**Dr. J. D. Osmond:** I would like to reply to Dr. Dixon that the case that has been treated with roentgen ray can catch cold, the same as any other. That is one of the difficulties. In reply to the thickened membrane, hyperplastic membrane of the polyps, if polyps are present I would have them removed by the Caldwell-Luc operation, but if it can be treated before polyps are detected, there is an advantage to be gained by many roentgen ray treatments of sinusitis.

I remember that years ago the one question was, what can you do to cure chronic sinusitis? and this is what we have emphasized in the use of the roentgen ray. Use it early. Use it before a case becomes chronic, if possible, of course with plenty of drainage, irrigation, and all that. The radiologist can only come in occasionally. If polyps are present, remove them surgically, because roentgen ray treatment is not going to do it. We positively stated this in 1922.

## TECHNICIANS' EXAMINATIONS

The American Registry of Physical Therapy Technicians announces that examinations for Registered Physical Therapy Technicians will be held in various cities as the demand arises on dates to be announced later during May and June. Applications should be filed as early as possible. Write to the American Registry of Physical Therapy Technicians, 30 North Michigan Avenue, Chicago.

## NEWER DEVELOPMENTS IN ORTHOPTICS, WITH REFERENCE TO READING PROBLEMS \*

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Normal binocular single vision is the result of a proper functioning of the two retinae, associated with perfect coordinated control of the eyeballs, by normally developed extrinsic muscles. This is orthophoria; any deviation from the normal is heterophoria.

Normal or abnormal correspondence is a more or less relative term; a condition of normal retinal correspondence to one author, may be thought of as an abnormal retinal correspondence by another.

It is now generally assumed that the individual is born with certain inherent potentialities; such as the possibility to fuse objects when they are focused on the exact corresponding points on each retina, and that these points are controlled by certain corresponding neurons, which eventually lead to exact corresponding positions in the centers, so that the slightest deviation from this pre-intended binocular retinal coordination would result in an abnormal retinal correspondence and abnormal projection.

It has been suggested<sup>1</sup> that retinal correspondence is developed upon the neuronic mechanism, which exists at birth, and that fusion is the result of training and growth, and that the location of the corresponding retinal centers is dependent upon the environmental factors rather than predestined centers.

A very interesting argument concerning the cause of the muscular anomalies by Marlow<sup>2</sup> should be attractive to the student in orthoptics. In a profound study of the variations of the ocular muscle functions he gave facts which cannot be ignored. His conclusions are that the etiologic factors of the variations in ocular muscles and their functions are based upon evolutionary principles. In his study of 700 cases, orthophoria was present in only 3.4 per cent, and exophoria was present in 78 per cent, and varied from 1 to 30 degrees. Exophoria was present in 13.2, making a total lateral phoria of 91.2, while vertical phorias were present in 84 per cent. Our findings do not substantiate this high percentage of vertical phorias. This startling high percentage presents a large field of action for the orthoptic technician.

The percentage of heterophoria is high. Bielschowsky<sup>3</sup> found it in more than 80 per cent of cases, and more than 41 per cent of these were combined with an apparent disassociated vertical deviation.

Hidden beneath the great array of ocular deviation and associated conditions, are the etiologic factors which often are unknown and present a gigantic obstacle in the attempt to correct them.

According to some authors, vertical imbalance<sup>4</sup> is more and more becoming recognized as a real hindrance to the correction of lateral imbalance, either by training or surgery.

Law<sup>5</sup> described his results in 91 cases of orthoptic training, stressed their uncertainty, and believes that the medical literature has presented too optimistic tabulations.

\* Read at the Nineteenth Annual Session of the American Congress of Physical Therapy, Cleveland, Ohio, September 14, 1940.

Smith<sup>6</sup> states that false projection occurs in about 50 per cent of cases of convergent squint, and is a barrier to easy successful treatment. She asserts that "fifty per cent of patients with concomitant convergent squint, having normal projection, can be treated with every confidence of success by any method which seems advisable to the ophthalmologist; but the 50 per cent, having false projection are in an entirely different category."

The results of treatment of heterophoria vary a great deal with the different observers. Wells<sup>7</sup> gives as his findings: "Exophoria for distance — cured or relieved, 70 per cent. Convergent inefficiency — cured or relieved, 86 per cent." In our<sup>8</sup> report of 81 cases of lateral strabismus treated by orthoptics, refraction and occlusion, 43 cases, or 54 per cent were corrected.

Dumphy<sup>9</sup> concluded after observing 29 patients with concomitant strabismus, that orthoptic training is probably of value to a small group of squint patients, who have normal retinal correspondence and well developed binocular vision, and whose angle of squint is not more than 10 degrees when glasses are worn, and that such training does not create binocular vision when the function is absent.

Reading difficulties are in most cases the results of visual and muscular anomalies and constitute a big problem in our schools, especially among the lower grades; but is not wholly confined to the young, as all ages may be affected. Therefore, muscle anomalies and their effects upon the individual become an educational as well as a medical problem, rendering it essential that the ophthalmologist and the orthoptic technician should be closely associated with schools<sup>10</sup> and other educational institutions.

Patients with reading problems may be classified into those having good mentality and ocular defects; this type usually being able to make adjustments and accommodate themselves to their handicap. Also, there are the individuals with lower mentality, associated with visual and motor anomalies, who do a very poor job in their feeble attempts to overcome their handicaps. Still another group have reading difficulties due entirely to mental defects; a very large percentage of mental defective individuals, however, suffer from ocular defects as well.

Children with reading difficulties present errors of refraction, muscular anomalies, fusional defects, and the like. These are potential patients for orthoptic training.

Berner and Berner<sup>11</sup> give a comprehensive description of the causes of reading difficulties and describe an outline for treatment. The following phases of ocular deficiencies are responsible for reading difficulties: (1) Reversals, probably due to confusion in the eye-hand associated pathways; perhaps associated with an under-development of all of the visual apparatus. (2) Low degrees of hypermetropia, a common condition observed by all ophthalmologists, the child becoming a better reader after the error of refraction is corrected. (3) Deficient fusion, which results in a complete breaking of the fusion, resulting in monocular convergent concomitant squint, usually offers no resistance to reading as the patient suppresses the converging eye and reads with the fixating eye only; but a partial correction, either by correcting lenses or surgery, or insufficient orthoptic training, offers resistance to the act of reading. This should be corrected as rapidly as possible by diligent and persistent training, and can be aided by alternate occlusion of the eyes. (4) Deficient fusional convergence, which is associated with early monocular suppression of the vision. Here the reading is difficult because it is accomplished mainly by the dominating eye and is retarded by intermittent flashes of vision in the suppressing eye. This is better diagnosed by use of the stereoscope and the small keystone dots, or of Wells' "F-L" chart. It shows up readily on the ophthalmographic record.

### Treatment

The various steps in the treatment of muscular anomalies are recorded by Lancaster<sup>12</sup> and seem to follow closely the general concept of the proper routine in orthoptic training, namely, reestablished retinal correspondence; establish fusion; development of fusional amplitude; surgery (if necessary), and post-operative training.

As regards the use of prisms, we agree with Maxwell's<sup>13</sup> views, and highly recommend their use for convergent insufficiencies and for hyperphoria of more than one prism diopter. During the orthoptic training the prisms should be worn only when the muscles present symptoms of fatigue, continually when orthoptic training is not available.

The following study was carried on in the Psychological Research Department of National College of Education by the various members of the department, under the direction of Louise Farwell Davis, Ph.D.

During the past three years in which we have offered visual training, we have kept running records of the type of training deemed necessary for each individual, along with the responses as given to each activity presented during the half hour. We have continued our routine intelligence and school achievement tests, and introduced any new diagnostic test which has interpretive values. Our tests of visual functioning may not be as adequate as they should be, but to date they seem to be the most discriminating for school needs.

We have rejected any child with an intelligence rating of less than normal, feeling that in such cases non-success is largely due to lack of ability, and although visual training might help, the prognosis is poor. In this study we did not include strabismus cases because we are interested in visual functioning as it affects academic achievement and most of the cross-eyed children in our school are very successful. The few who were not successful were trained from the standpoint of academic achievement. Any straightening of the eyes was incidental to this, and would constitute a separate study.

We supplemented the Keystone series of tests of visual functioning with one in fusion range; a test with a reduced Snellen chart to check static focus and change in focus, as well as a subjective rating on binocular and monocular pursuit fixations. The seventeen specific test items are listed below.

1. Low or unequal visual acuity.
2. Suppressed vision in the left eye.
3. Suppressed vision in the right eye.
4. No depth.
5. Low depth.
6. Vertical imbalance.
7. Failure in fusion at the far point in a handicap test.
8. Failure in fusion at the near point in a handicap test.
9. Lateral balance at the far point.
10. Lateral balance at the near point.
11. Low ratio in ductions.
12. Slow recovery to a single image after break in duction test.
13. Unequal static focus or low focusing ability.
14. Minimum or below minimum change in focus.
15. No ability to change focus.
16. Binocular pursuit fixations.
17. Monocular pursuit fixations.

One hundred and sixty subjects were divided for comparative study into four age groups:

1. Five and six years..... 42

2. Seven, eight and nine years .....	41
3. Ten to fourteen years.....	37
4. College women .....	40
Total number .....	160

Of these, our records show that the following number were wearing a correction: three or 7.3 per cent among the five and six year group; nine or 24.4 per cent among the seven, eight and nine year group; ten or 21.4 per cent among the ten to fourteen year group; and thirty or 86.1 per cent among the college women.

With the seventeen test items in mind, the number corresponding to the number of the test in the above list the frequencies of difficulties were as follows:

TABLE 1.

Age:	5 and 6	7 to 9	10 to 14	College	Totals
1 .....	26	15	26	15	79 or 49.3%
2 .....	17	4	5	5	31 or 19.3%
3 .....	1	3	10	2	16 or 10. %
4 .....	21	6	10	4	41 or 25.5%
5 .....	15	10	6	19	50 or 31.2%
6 .....	0	1	6	0	6 or 3.7%
7 .....	7	9	18	9	43 or 26.8%
8 .....	30	25	23	27	105 or 65.6%
9 .....	10	12	10	12	44 or 27.5%
10 .....	3	3	4	7	17 or 10.6%
11 .....	13	11	19	20	63 or 39.3%
12 .....	22	13	11	20	66 or 41.2%
13 .....	12	23	22	27	84 or 52.4%
14 .....	8	29	31	26	94 or 58.7%
15 .....	3	0	2	13	18 or 11.2%
16 .....	35	27	28	16	106 or 66.2%
17 .....	38	33	35	29	135 or 84.2%

The important findings here are:

1. The five and six year children group have low or unequal visual acuity; no depth; fail to fuse images at the near-point; have a slow recovery to a single image in the duction test; and poor pursuit fixations.

2. The seven to nine year children group fail to fuse images at the near-point; have low duction ratios; inadequate skill in changing focus, and poor pursuit fixations.

3. The ten to fourteen year old patients have low or unequal visual acuity; fail to fuse images at both far and near points on handicap fusion tests; have inadequate fusion range; low focus and lack skill in changing focus; and poor pursuit fixations.

4. The college women have low depth of vision; fail to fuse images at the reading point; have inadequate fusion range; slow recovery; unequal or low static focus; lack skill in changing focus; and little monocular skill in following a slowly moving light.

A comparative study was made between the initial and subsequent tests in visual functioning on children who had no training with a similar number of children who had such benefit.

There were thirty-nine children in the "no training" group; eighteen girls and twenty-one boys, ranging in age from five to twelve years. The interval of months between initial and final tests was from three to sixteen, the average being 8.74 months.

There were forty-three children in the "training" group; nine girls and thirty-four boys, ranging in age from five to thirteen. The training periods of a half hour each were carried on over five months in the average case, the longest period being nine months, the shortest, one month. The number of



training periods per child ranged from seven to twenty-five; the average being thirteen.

Table 2 shows the gains and losses made by comparing the final with the initial tests for children who have had training with those of children who have had none. We could not always test each child for the complete series, or the child might not have responded when tested. Under the column headed "Same Response," no attempt has been made to differentiate between those who originally passed and still passed the test, and those who failed and still failed to pass.

TABLE 2.

Term Items	—SAME RESPONSE—		LOSS		GAIN	
	No Train. No. %	Training No. %	No Train. No. %	Training No. %	No Train. No. %	Training No. %
1. Suppression of both eyes or low amount of visual acuity .....	14-36.0	21-48.8	8-20.5	0-	17-43.6	22-51.2
2. Suppression of left .....	13-33.3	18-41.9	7-18.0	2- 4.5	19-48.7	23-53.5
3. Suppression of right .....	11-28.2	13-30.2	10-25.6	0-	18-46.2	30-70.0
4. Stereopsis or depth of vision.....	14-36.0	29-67.4	3- 7.4	0-	22-56.4	14-33.8
5. Failure in fusion at far point.....	21-53.8	30-70.0	10-25.6	3- 6.9	8-20.5	10-23.2
6. Failure in fusion at near point.....	26-66.7	22-51.2	4-10.3	1- 2.3	9-23.1	20-46.4
7. Lateral balance at far point.....	31-79.5	36-83.7	6-15.3	0-	2- 5.1	7-16.4
8. Lateral balance at near point.....	35-89.7	38-88.3	3- 7.7	5-11.6	1- 2.6	0-
9. Low duction ratio —						
Break .....	20-51.3	16-40.0	9-23.1	5-12.5	10-25.6	19-47.5
Recovery .....	13-33.3	18-45.0	11-28.2	5-12.5	15-38.4	17-42.5
10. Low recovery —						
Abduction .....	18-46.2	17-44.7	14-36.0	7-18.4	7-18.0	14-36.8
Adduction .....	7-18.0	14-34.1	16-41.0	5-12.2	16-41.0	22-53.6
11. Unequal static focus .....	8-23.2	22-55.0	13-38.2	4-10.0	13-38.2	14-35.0
12. Low amount static focus .....	8-25.0	15-36.6	12-37.5	2- 4.8	12-37.5	24-58.5
13. Low or no change of focus.....	7-26.9	7-17.1	10-38.4	10-	9-34.6	34-83.0
14. Poor binocular pursuit fixations .....	31-83.8	3- 7.3	1- 2.7	0-	5-13.5	38-92.7
15. Poor monocular pursuit fixations .....	31-93.9	4- 9.5	1- 3.0	0-	1- 3.0	37-90.2

Study of these comparisons reveals that there were many more losses for those who had no training than those with training. The gains were considerably greater for those with training in the following items:

- 1.) Binocular suppression or low visual acuity (by this we mean that they tested lower binocularly than monocularly) was improved.
- 2.) There was less suppression in the right eye.
- 3.) Fewer failed the near point fusion test.
- 4.) Lateral balance at the far point improved.
- 5.) The duction ratio (ratio between the break and recovery) was better.
- 6.) Both the abduction and adduction recovery points were higher.
- 7.) Static focus improved.
- 8.) Dynamic focus or the ability to change focus from a distant object to a near one and back again and still see just as clearly as in the beginning, was also improved.

9.) Both binocular and monocular pursuit fixations (ability to follow a slowly moving object skillfully) was improved.

If the "twenty-three" card set had been used in testing stereopsis, those with training would have shown greater progress than is indicated by the gross test, which was used.

A comparison was made between the academic gains made by the children in our Demonstration School with those who have had a variety of corrective procedures (table 3). From January, 1939, to May, 1939, for eighty-six children (twenty-three special cases and sixty-three in the control group) the median gains were:

TABLE 3.

	Grades 2 to 5 Class Medians	23 Special Cases Averages	Grades 6 to 8 Class Medians
Silent reading .....	10 months	10 months	11 months
Oral reading .....	12 months	11 months	.....
Spelling .....	9 months	7 months	12 months
Arithmetic reasoning .....	6 months	7 months	16 months
Arithmetic computation .....	6 months	.....	11 months
Total Grade Scores.....	8 months	9 months	12 months

The same type of progress is shown for the semester from September, 1939, to February, 1940 (tables 4 and 5).

TABLE 4.

	Grades 2 to 5 Class Medians	10-12 Special Cases * Averages
Silent reading .....	9 months	6.3 months
Oral reading .....	4 months	5.5 months
Spelling .....	4 months	3.7 months
History and Geography.....	.....	.....
Total Scores .....	7 months	7.0 months

\* (Not every child needed help in each subject; however, there were not less than 10 or more than 12 under any one classification.)

TABLE 5.

	Grades 6 to 8 Class Medians	10-12 Special Cases * Averages
Silent reading .....	5.2 months	7.8 months
Oral reading .....	.....	.....
Spelling .....	8.7 months	8.1 months
History and Geography.....	8.3 months	9.1 months
Total Scores .....	5.3 months	5.3 months

In other words, the children who have met with learning handicaps, even though they have normal or above normal predictions for learning, can advance quite normally when a variety of corrective procedures are planned. Individual instruction is necessary for some, membership in a small group for others.

Thirty-three children with normal or above normal predictions for learning were selected at random for a study of preference, binocular and monocular pursuit fixations, and Gray Oral Reading Check Tests, (binocular and monocular oral reading).

Their preference of hand, foot, eye and ear were (table 6):

TABLE 6.

Hand	Foot	Eye	Ear	No.	Percentage
R	R	R	R	11	33.3
R	R	L	L	8	24.2
L	L	R	R	1	3.0
R	R	L	R	4	12.1
R	R	R	L	5	15.1
L	R	R	R	1	3.0
L	L	L	R	1	3.0
Ambi	R	L	R	1	3.0
R	L	L	R	1	3.0
				33	99.7

\* (Not every child needed help in each subject; however, there were not less than 10 or more than 12 under any one classification.)

As can be seen, the highest percentages are in consistent right preference for hand-foot-eye-and-ear, while the next higher ones are in the mixture of right hand and right foot, with left eye and left ear. These findings agree with other similar studies we have made. Fifty-four and five-tenths per cent of the cases preferred the right eye, and 45.5 per cent the left eye.

In regard to the pursuit fixations of these children, 33.3 per cent had very little ability in following a slowly moving light; 63.7 per cent did better with both eyes working together than with either eye alone. The preferred eye was more proficient in following in 36.1 per cent of the cases; the non-preferred eye following more skillfully in 41.7 per cent of the cases. In 22.2 per cent the examiner was not able to state which was poorer or better.

A study of binocular and monocular reading of the Gray Oral Reading Check Tests indicates the interesting facts that the preferred eye read more accurately in 41.7; was poorest in 25.0, and held an intermediate position in 33.3 per cent of the cases.

In comparing the reading records of the thirty children for binocular and monocular opportunities, in 20.0 per cent of the cases there was perfect agreement between the subjective judgment in pursuit fixations and the reading; in 23.3 there was agreement as to which was best, and in 23.3 as to which was poorest, while in 33.3 per cent there was total disagreement.

Along with their reading disability, these children presented a variety of problems such as fear of tests, dislike of school, lack of inner ambition and drive, ingoing natures, tension, self-consciousness or jealousy. Some had glandular disturbances, others displayed inadequate concentration, poor work habits, disgust over failures, and an "I don't care" attitude as a compensatory response.

Our opinion derived from meeting and working with over three hundred of these children during a period of eight years, is that they are appreciative of help, thrive under daily successes, are alert and attentive to other school activities, such as arithmetic, and are normally responsive in other life situations. They do need temporary specialized instruction, and unless the emotional patterns are too negative or unless these children fatigue too readily; they do make normal progress in reading within the first semester, and later in spelling.

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(For discussions, see page 238)

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## CONDUCT OF AN ORTHOPTIC CLINIC \*

I. S. TASSMAN, M.D.

PHILADELPHIA

During the past five or six years considerable progress has been made in knowledge and understanding of orthoptic training and the types of cases benefited by this method. Moreover, many hospitals have found it advantageous to conduct an orthoptic clinic in connection with the regular eye department. It is the purpose of this paper to present some of the salient characteristics for the successful maintenance of such a clinic.

### General Plan and Purpose

An orthoptic clinic should be considered as part of the regular eye department devoted to the care of patients who in the opinion of the ophthalmologist, might be benefited by special training. Under his direction it should provide the following means for the treatment of certain types of heterophoria and squint:

1. — Orthoptic exercise and training in cases of heterophoria of sufficient degree to cause troublesome symptoms that are not sufficiently relieved by careful refraction and other forms of treatment. Chief among these are cases of exophoria with a weakness of convergence. These are encountered rather frequently among all classes, but particularly among presbyopic patients who wear bifocal lenses. They complain of inability to read for any reasonable length of time in spite of the fact that their refractive condition has been properly corrected by lenses. With orthoptic exercise and training in overcoming the effect of prisms base out in front of the eyes and thereby relieving the convergence, improvement can be obtained in a comparatively short time.

2. — The correction of amblyopia and improvement in vision in an amblyopic eye, especially in children suffering from squint who are under the age of six or seven years. This is usually accomplished by occlusion for the fixing eye in monocular squint, for the greater part of the day and

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\* Read at the Nineteenth Annual Session of the American Congress of Physical Therapy, Cleveland, Ohio, September 4, 1940.

over a period of time, depending on the improvement in visual acuity obtained. A record is made of the visual acuity on each visit of the patient.

3. — The preoperative and postoperative management and treatment of squint with its accompanying defects and abnormalities. These include especially, suppression, diplopia, abnormal retinal correspondence, overconvergence from excessive use of accommodation and absence of fusion, especially in cases of monocular and alternating concomitant squint. All cases of squint with a deviation up to about 20 degrees can be referred to the orthoptic clinic for the purpose of reducing the angle of deviation, improvement of vision in the deviating eye, establishing fusion and single binocular vision before operation. These cases usually respond satisfactorily within three months if treatment is given at least once a week. Such treatment should be continued for about six months before operation is performed.

Patients with a deviation greater than 20 degrees of squint, respond more slowly, but preoperative treatment in the orthoptic clinic can be employed with satisfaction for a better operative result. Even with a large degree of squint, amblyopia and suppression can be overcome in the orthoptic clinic, so that at least superimposition or first degree fusion can be obtained before operation. With the visual axes parallel or nearly parallel after operation, orthoptic treatment can be resumed with better possibilities of establishing single binocular vision.

The orthoptic clinic can serve as a valuable adjunct in the postoperative treatment of these patients and when a satisfactory surgical result has been obtained. They should be returned for an immediate attempt to establish single binocular vision. In cases with an overcorrection of a lateral deviation or with a resultant vertical deviation, the postoperative treatment should be continued. Satisfactory results can be obtained in some cases of postoperative hyperphoria when this condition is not too pronounced.

#### Equipment and Facilities

Detailed descriptions of most of the orthoptic appliances have been published by Mayer.<sup>1</sup> The required equipment depends largely on the size of the eye clinic or hospital with which the orthoptic section is associated and the number and kind of cases treated. This should, however, for the average clinic include most of the diagnostic instruments and accessories, as well as at least one major appliance for both diagnostic and treatment purposes of any of the cases referred. Among the latter are included such major amblyoscopes as the synoptophore, synoptoscope, orthoptoscope, rotoscope, stereo-orthopter and Tel-Eye-Trainer. The cheiroscope is an essential addition to any clinic because it is useful in training the use of the deviating or weaker eye while employing the hand in drawing. The instrument has a mirror which reflects the image of the picture to be drawn by the patient and can be adjusted for the eye to be exercised.

All of these major appliances are built on the principle of the stereoscope and are mostly employed for the same purpose. The synoptophore and synoptoscope have been largely employed in this country as well as in England, and possess certain advantages in diagnosis and treatment. These are almost impossible to obtain at the present writing, since they are imported. The rotoscope or stereo-orthopter and Tel-Eye-Trainer which are manufactured in this country can be employed with equal satisfaction for most purposes in nearly all of the cases.

The following list represents essential equipment in addition to that just described:

1. A prism rack to 30 diopters.
2. One prism set to 60 diopters.
3. Set of maddox rods for testing muscle balance.



4. One Worth 4 Dot Test for far and near with corresponding red and green spectacles.
5. One Prince Combination rule, for measuring near point and accommodation. One Metal Combination rule (Ralph, Pryxal and Hill, New York City).
6. Jaeger cards for testing near vision. Duane card or accommodation card for use with Prince rule.
7. Two long handled occluders.
8. One red glass diplopia disc.
9. White target pins for convergence test.
10. Two small flash lights.
11. Snellen charts for testing visual acuity. Illiterate E chart for testing visual acuity in young children.
12. One muscle light on wall.
13. Occluders for amblyopia.
14. One trial frame.
15. One or two hand stereoscopes and cards.
16. Maddox Wing Test.
17. Stereo-Campimeter.

The orthoptic clinic preferably should adjoin the regular eye clinic, but in no case, should it be conducted in the same room and at the same time as the regular eye clinic. The size of the room will depend largely on the number of cases to be treated. The average room should be at least 20 feet long and 15 feet wide. This affords sufficient distance for testing the vision and accommodating the minimum of clerical and orthoptic equipment required. Instrument tables and a chair with a revolving, adjustable seat should be provided for each major appliance. A high, straight back chair with adjustable seat is satisfactory in testing the vision, muscle balance, ocular rotations and screen and parallax tests. A separate room should be provided for parents or persons accompanying patients.

More than one patient can be examined or treated at the same time if facilities are provided for separating patients in the same room by curtains or partitions, so that their attention is not detracted.

A separate record should be kept in the orthoptic clinic for every case. A transcript of the progress chart should be submitted to the eye department referring the case. The record should include a detailed history with particular attention to the diagnosis, age, time of onset in cases of squint, family history (especially with reference to squint cases), record of the refractive error (obtained from the eye clinic or the ophthalmologist), how long glasses have been worn and results obtained from their use, operations and type of operations. (See form *I, A* and *I, B*.)

#### Organization and Routine Procedure

The most important feature of an orthoptic clinic is the organization and routine of procedure. The successful operation depends largely upon the personnel, particularly the orthoptist in charge. The clinic should be conducted under the direction of an ophthalmologist. The work should be performed by an orthoptic technician who has had a regular course of instruction and training in this work. If the clinic is large enough, one may have to employ assistant orthoptists and a secretary or typist for clerical work.

The importance of the personality and ability of the orthoptist in charge, cannot be overestimated. In addition to such qualifications as confidence, patience, enthusiasm and zeal, it is necessary to carry out the treatment only as directed by the ophthalmologist in charge of the case. Often we must depend on the ability of the orthoptist to cooperate, but it should be a rule that the patient be sent back to the ophthalmologist or eye clinic re-

**FORM 1-A**

Phone: \_\_\_\_\_ (History Attached)

ORTHOPTIC DEPARTMENT Dr. I. S. TASSMAN

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Patient \_\_\_\_\_ Age \_\_\_\_\_ Date \_\_\_\_\_

Address \_\_\_\_\_ Clinic Dr. \_\_\_\_\_ Bk \_\_\_\_\_ Pg \_\_\_\_\_

PRE- } OPERATIVE.  
POST- }

FIRST OPERATION Type \_\_\_\_\_ Date \_\_\_\_\_ Dr. \_\_\_\_\_

SECOND OPERATION Type \_\_\_\_\_ Date \_\_\_\_\_ Dr. \_\_\_\_\_

REFRACTION C.D. VISION SC O.D. O.D.

Date: SC CC O.S. O.S.

Doctor: O.S. FULL CUT

---

REFRACTION

Date: O.D. NEAR O.D. cm.

POINT O.S. cm.

Doctor: O.S. FULL CUT

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MUSCLE BALANCE

SC—S. & P. } 6 m.

33 cm. AMBLYOPIA-EXANOPSIA: O.D. O.S. O.U.

C.C—S. & P. } 6 m.

33 cm.

SC—S. & P.

C.B. Test } 6 m.

Worth 4-Dot Test } 33 cm.

Maddox Rod } DIAGNOSTIC TREATMENT

Red Filter } Fusion Test { 1st Degree

2nd Degree

3rd Degree

C.C—S. & P.

C.B. Test } 6 m.

Worth 4-Dot Test } 33 cm.

Maddox Rod }

Red Filter }

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(Type and Degree of Strabismus)

DIAGNOSIS:

REMARKS:

**FORM 1-B**

ORTHOPTIC DEPARTMENT Private File \_\_\_\_\_

Phone \_\_\_\_\_ Clinic Dr. \_\_\_\_\_ Bk \_\_\_\_\_ Pg \_\_\_\_\_

Referred by \_\_\_\_\_ Date \_\_\_\_\_

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Name \_\_\_\_\_ Age \_\_\_\_\_ Date of Birth \_\_\_\_\_

Address \_\_\_\_\_ Occupation \_\_\_\_\_ Nationality \_\_\_\_\_

1st Operation — Type \_\_\_\_\_ Date \_\_\_\_\_ Doctor \_\_\_\_\_

2nd Operation — Type \_\_\_\_\_ Date \_\_\_\_\_ Doctor \_\_\_\_\_

Hospital \_\_\_\_\_ Surgeon \_\_\_\_\_

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CHIEF COMPLAINT: (Asthenopia, Headaches, Diplopia, Nausea, etc.)

FAMILY HISTORY: (Especially Squint)

PATIENT'S HISTORY:

(I.Q. Psychological Difficulties, Mental Development, Stammering, School Record, Hand Used, etc.)

P.M.H.: (Serious injury or illness, injuries to head, birth injuries (forceps), congenital defects, defects in speech, hearing or locomotion.)

P.E.H. (Lenses worn — how long? Last examination — under cycloplegic? Previous Orthoptic Training — how long — what kind? Surgical procedure — what — by whom — where and when? Occlusion — how long? Drops, what kind — how long? Etc.)

H.P.I. (Date of onset, cause or possible cause.)

PHYSICAL FINDINGS:

I. Field of Vision (Central Scotoma?)

II. Inspection (Furrows in brow, head tilts, drooping of lids, etc.)

## FORM 2

ORTHOPTIC CLINIC				EXERCISES:	Instrument:
Date _____					
Name _____		Time _____			
Screening		Screening			
No Screening		No Screening			
SC	O.D. _____	CC	O.D. _____		
SC	O.S. _____	CC	O.S. _____		
SCREEN AND PARALLAX TEST					
6M	SC	_____	25 cms.	EXERCISES:	Instrument:
6M	CC	_____	25 cms.		
INSTRUMENT:				OCCLUSION:	
SUPERIMPOSITION: { Objectively —					
{ Subjectively —					
FUSION:				HOME EXERCISES:	
Divergence —				Recovery	
Convergence —				Recovery	

## FORM 3

Date	Vision	Record of Orthoptic Treatment	File No.	Pg. No.

ferring the case, at regular stated periods for continued observation. Such periods should not exceed an interval of six weeks or less, depending on the nature of the case and the desire of the person responsible for the treatment. Although a certain amount of interpretive ability might be acquired with experience, certain important features which are presented from time to time in nearly every case, should be interpreted only with the aid of and consultation with the ophthalmologist. Changes in the form of treatment prescribed, indications for the time of operation, as well as other decisions should be arrived at in this way. A good orthoptist should also be able to enlist the cooperation of patients, especially of children or their parents and to exact compliance with certain orders that may be necessary to be carried out in connection with the treatment. Directions for home training are given to the patient or parents. These include specific instructions for exercise with the use of loose prisms or in other instances with a hand stereoscope. Standard printed or mimeographed forms may be employed for this purpose.

The clinic should be conducted during stated hours and days according to requirements. All patients should be seen by appointment on an average of once each week. In some instances two visits each week might be considered necessary at first while in a few, one visit in two weeks might be all that is required.

The patient usually is carefully examined on the first visit, the time required being about 45 minutes. Subsequent visits for the purpose of exercise and treatment should not exceed 30 minutes.

It is well to employ a daily work sheet, listing the test, exercise, visual acuity and treatment for each particular day. This can then be carried over later and incorporated with the continuance record of the patient. (See forms 2 and 3.)

Various methods of procedure in the management and treatment of these cases have been described in the past by Guibor<sup>2</sup> and Davis.<sup>3</sup>

A good routine includes making a record of the condition of the eyes of the patient as found by the referring eye department and a request for a particular line of treatment by the orthoptic clinic. Also a request to return the patient at certain stated intervals for a check-up. The refraction and its date should be given. If this has not been recent, the patient should receive a refraction and proper glasses prescribed before going to the orthoptic clinic. On first examination, the routine examination consists of the following procedures: (1) A test of the visual acuity for distance and near, with and without glasses. In small children who are too young to read, this can be done after teaching the child, with the use of illiterate E cards. (2) Screen and parallax tests at 6 meters and 25 cms., both with and without glasses in the six cardinal directions. (3) Excursion test with a small pin or light, to note the rotations of the extra-ocular muscles and determine any limitation of motion or overaction. (4) Cover test for comitance and to determine secondary deviation. This is done by covering one eye with a card while both eyes are rotated to note any difference in deviation of the two eyes when first one eye is covered, and then the other. (5) The Worth 4 Dot Test; Employed for 6 m. and 25 cm., while the patient wears a pair of spectacles with a red glass in front of the right eye and green glass in front of the left eye. This is an important test to determine the presence of single binocular vision, suppression of one eye or diplopia. (6) Near point of convergence and accommodation as measured with the Prince rule. At the same time, the interpupillary distance can be measured. (7) Prism duccion tests at 6 m. and 25 cms. (8) Maddox Rod test, for phoria at 6 m. and Maddox Wing test for near. (9) Measurement of angle of deviation in squint cases and to determine presence or absence of true projection on one of the major orthoptic appliances such as the synoptophore or rotoscope. (10) Determine the degree of fusion present by use of one of the major appliances already named, first, by using two dissimilar targets, such as the bird and cage, which, when seen by the patient as one, will indicate superimposition. When two similar targets are seen by the patient as one, the presence of fusion is indicated. The presence of stereopsis or stereoscopic vision is indicated when the patient can recognize slides with depth and distance in the position or location of the various characters. Following any form of treatment, a case may be considered improved, but should be considered cured only when single binocular vision has been established, as indicated by the presence of stereoscopic vision and the ability to see 2 red and 2 green dots when tested with the Worth 4 Dot Test.

### Summary

The conduct of an orthoptic clinic has been described with reference to its general plan and purpose. The indication and need for such a clinic should first be determined by the number and type of cases treated by the regular eye department. The types of cases benefited by such a clinic working in cooperation with the regular eye department are discussed. The orthoptic clinic should serve as an aid to the regular eye clinic in the management and treatment of certain cases of heterophoria for the preoperative treatment of squint, for overcoming amblyopia, suppression, diplopia, abnormal retinal correspondence and for improving the degree of fusion. It should also serve as an aid for the same purposes in postoperative care.

An orthoptic clinic properly equipped for this purpose, which is under the direction of an ophthalmologist with the assistance of a well-trained orthoptist who cooperates in carrying out the details of the orthoptic pro-

cedures, can be of great service to any regular eye clinic, hospital or ophthalmologist in the management and treatment of indicated cases.

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### Discussions of Papers by Dr. Oscar Nugent, Miss Vivienne Ilg, and Dr. I. Tassman

**Dr. B. J. Wolpaw** (Cleveland): I was very glad to hear Dr. Nugent refer to the works of Law, Mildred Smith and Dumphy, all of whom are conservative in their claims for orthoptics and who appear to realize its limitations, better than do most authors on the subject whose conclusions often sound like wishful thinking.

Dr. Nugent makes one very important point that I should like to emphasize. He stated that reading difficulties are not confined entirely to the young, as all ages may be affected. I personally feel that the use of orthoptics among adults has been greatly neglected. There is a large group of individuals who have convergence insufficiencies that handicap their daily work and their ability to earn a living and who are neglected in favor of the child whose teacher reports that he misspelled a word at school. On this subject Dr. Tassman has one paragraph which to me was worth his entire paper. In listing the cases to be treated he said: "Cases of heterophoria which, in the opinion of the ophthalmologist, are of sufficient degree and type as to cause troublesome symptoms which are not relieved by ordinary careful refraction and prescribing of proper corrective glasses, chief among these are those cases of exophoria with a weakness of convergence." I repeat this paragraph because Dr. Tassman emphasizes two points, first, that the heterophoria must produce troublesome symptoms and secondly, that the patient should have a careful refraction. We have all seen patients who had exophoria for near and far, for years and yet have no reading disabilities. It would hardly appear necessary to urge that a careful refraction be done before orthoptics is administered, yet I have seen children who have been examined at school, either by the school physician, who knows little about the eyes or by a teacher who knows even less, and have been given orthoptic training before they have been refracted.

I should like to ask Dr. Nugent whether all of the 160 subjects in his report were first refracted and if those who were not normal were allowed to continue their regular work, after glasses were prescribed, to see if there was any improvement in both their school work and in the 17 specific tests. The original paper

presents the percentage wearing glasses when entering the special class, but does not state whether these refractions were checked for accuracy and whether those not wearing glasses were refracted.

Dr. Nugent quoted Berner and Berner's statement concerning reversals—these authors feel that reversals are perhaps associated with an underdevelopment of all of the visual apparatus. I frankly cannot believe this to be true. Reversals among children are not uncommon, but almost unknown in adults. I cannot believe that a child, of school age, can have an underdevelopment of all of the visual apparatus, and yet grow up to be an adult, without any reversals, in other words an adult with a properly developed visual apparatus. I think a little more conscientious training by the teachers and mothers will correct more reversals than the use of orthoptics.

I agree fully with the essayist that many cases of so-called reading problems are due to lowered mentality and that no amount of orthoptics will aid. It may be less painful to the oculist to prescribe orthoptic training, in these cases, than to tell the parents that their child is mentally below par.

I have seen children classified as reading problems, because they could not do their school work, and yet they had no difficulty in reading volumes of comic magazines. These children have been sent to special reading and orthoptic clinics without avail. I really feel that many reading problems would get better results, if the mother of the child spent more time at home, working with the child, and less time at bridge.

There is a growing tendency in our school system to classify every move a child makes at school upon a set scientific scale. This has been profitable to the oculist, the child psychologist and special reading classes, but has not always been fair to the child. Our school systems throughout the nation are in poor shape financially. In Cleveland there will be a thirty per cent reduction in teacher's salaries this year. In view of this, I should like to ask Dr. Nugent whether he feels that the end results justify the expenditure of large sums of money for special training classes. His 160 students had intensive, expensive special training,



yet in his summary he does not sound as enthusiastic about the end results, as one would expect him to be.

Do these results justify our asking parents to spend large sums of money for this type of training?

I would like to know, Dr. Nugent, whether you go into these cases from the psychologic point of view. I think these children need a good psychologic as well as a good muscular work-up, to see if there isn't something in the home that is diverting them or find some channel they do read well in but they may not care about their school work.

I thought it was an honest conclusion without too much enthusiasm for the results. Yes, they were better. The students were enthusiastic about the work. They fitted in well, worked well with the instructor, but is that enough for the expense involved? Are we justified in saying to a parent, "You are going to have to send your child once or twice a week at that expense" until we can promise more than you have shown us in your report of these 160 cases? I have a feeling we are entirely unfair to the children five and six and seven to use the muscle test on them, the fusion test, depth of vision, and draw any conclusions. We will treat them for 12 or 13 months and find they are better. Why five-year-old children are better when they are six years. They can read better. I have enough trouble getting muscle balances in adults and I certainly wouldn't place confidence in fusion, muscle balance tests of children, five, six and even seven years of age.

**Dr. Roy R. Reynolds** (Massillon, Ohio): It is pretty hard to see pathologically a normal and abnormal eye in this type of work. By much study the essayist has come to believe in the neurogenic theory. If you could see the beautiful slides he has prepared and see the eyes he brings to the clinic, you would understand what I mean. He was the first to interest me in this type of work, and since that time for five years I have carefully followed ten cases with the Nordenson retinal camera in color. These things cannot be brought out by the simple observation of one eye in comparison to the other unless these are carried along five or six or seven years. Then when you take the slides and color, there definitely comes out the differences in the two eyes, although there is no definite abnormality when we look at the fundus. This is more reasonably brought out and more clearly understood when we can get a definite microscopic section of the individual fundus. As I said, in this country we are unable to do this, but in Vienna, fortunately, he is in the position where he can have the assistance of many doctors who do the same kind of work, and has been able to accumulate 96 cases which has taken considerable time.

It is very difficult for us who specialize in a small town to follow ophthalmologic training as we could in cities like Philadelphia and Cleveland. Our problem be-

comes very much greater. The doctor has to consistently watch any nurse he is training for technical work in this line. Therefore, it becomes necessary and oftentimes ophthalmologic practice becomes cycloplegic.

Dr. Tassman has beautifully demonstrated and discussed the various different instrumentations that can be carried on in the clinic. While it is not possible for the average oculist to possess all these instruments, we have to rely on a few we have learned to use with thoroughness.

I agree that orthoptic training has brought out the importance of not too early surgical procedure on these cases which have been thoroughly gone into by Dr. Ruedemann, and as he has presented, we find many of these cases which have been operated on haphazardly naturally have the result as we often see that the amblyopic areas have changed in the retina. We can't expect to get anything more than a cosmetic result.

Dr. Wolpaw has brought out an important point in his discussion that adults themselves have been very much neglected. We have devoted too much of our time to children. As he says, reversals are really an approximate thing. Oftentimes what we call a reversal, in a brief or lengthy examination it would come out as a matter of mental defect or lack of attention, and I believe as a child grows older and as its mental intelligence gains the importance of these things which the child learns, we will bring out less of these defects and we will find that the amblyopic or partly amblyopic child will more or less correct itself by future training. But adults can no longer do this thing and, therefore, they do require further assistance.

Modern methods have been improved so much in the last ten years that our approach to the problem of muscle imbalance and its correction has changed completely. This change has been brought about not only by past mistakes, but more intense and rational approach to the problem with regard when an eye is ready for operative interference. There is also a more intelligent understanding on the part of the parents. This together with further scientific training, has produced our present methods of treatment and has taught us the following:

1. A careful examination of the mental status of the patient to be treated is essential to success.
2. A patient with retarded mentality is not suitable for orthoptic training and will serve to discredit the method.
3. An assurance of complete cooperation on the part of the parents of the patient to be treated.
4. A careful and thorough examination of the eyes under a suitable cycloplegic, repeated if necessary before a decision is made for orthoptic training.
5. A well organized clinic or an intense, unfaltering interest on the part of the technician.
6. A realization that the time factor is important as regards the final result.

7. Carefully compiled records to show the definite progress of each case.

8. A division in age limits, since our method of application will vary with the intelligence quotient.

9. Complete cooperation with the ophthalmologist and the technician or chief of the orthoptic training department.

10. Careful selection of patients suitable for surgical correction to be followed by further intensive orthoptic training.

**Dr. John E. L. Keyes** (Cleveland): The practice of orthoptics is now firmly established as an aid in the treatment of heterophoria and strabismus. A period of poorly controlled enthusiasm based on fragmentary knowledge and abetted by manufacturers of orthoptic apparatus has passed and a more conservative attitude toward orthoptics is now evident. It is no longer considered necessary to use complicated or expensive apparatus to obtain satisfactory results.

The practice of orthoptics is tedious and largely philanthropic. Orthoptic technicians are employed to alleviate this situation. The delegation of this work to a technician has increased the volume but not the quality of orthoptic training. Supervision by an ophthalmologist is necessary to insure good results and improvement in technic.

The establishment of binocular single vision with stereopsis is the ideal in the treatment of heterophoria and strabismus. Many persons are unable to attain this ideal, but improve sufficiently with orthoptic training to have comfortable and useful vision. Patients with asthenopia, heterophoria and a refractive error often obtain eye comfort even after mere correction of the refractive error.

The cure or prevention of monocular amblyopia before a child is six years of age is essential to successful treatment of any ocular muscle imbalance or visual fusion anomaly. Orthoptic treatment in young children is largely involuntary because of their fleeting power of concentration and requires close and constant supervision. Development of the fusion sense is obtained more rapidly and with less supervision in young adults with mature minds and an ardent desire for eradication of their visual defects.

Orthoptic training is of little avail in the higher degrees of aniseikonia.

**Dr. Oscar B. Nugent** (closing): It is not an easy task to attempt to classify any of the human elements, whether they be physical or mental, and in trying to do so, we probably have not gotten the proper classification but we have done the best that we knew how under the circumstances.

Miss Ilg has been very active in this college that spares no expense, as they have quite a staff of workers along this line.

Dr. Reynolds has asked if the 160 cases that were reported were eventually re-

fracted. I would like Miss Ilg to answer that question. I know they were not.

**Miss Vivienne Ilg** (closing): Most of the children in our school are routinely refracted by ophthalmologists in Chicago. Of course, they have their own individual doctors and we, as teachers, cannot recommend any specific individual, but if they want us to recommend someone, we give them a panel of names for them to choose from.

The reading cases come in to us from all over the country. Of course, most of those cases have had every possible consideration given to this problem. Some of them have had many examinations for eyes, psychologic tests and complete physical examinations which disclosed no difficulty. Our experience is that 75 per cent of the children that have reading disability do not need glasses, according to the ophthalmologists, and this agrees with studies by other educators.

**Dr. Oscar B. Nugent** (closing): I think that answers that.

Another question was the deficiency in all parts of the eye. I mentioned that in my part of the paper as being given by Berner and Berner. I can't believe that a child who has the reversals, the upside-down writing and reading, and the like, has a deficiency in all of the eye. I don't believe that, because as has been brought out in the discussion, one seldom ever sees it in an adult and we know these reversals don't all die before they reach that stage in life.

Now another question was. Have these children been studied from a psychologic standing? I will say yes, most thoroughly, because this part of our report came from the Psychological Department of this college.

Now the end results of these 160 cases—does it pay to go to all this expense of training these patients, that is, does the end result pay the cost or does it justify the cost? I won't ask Miss Ilg to answer that, because she is too enthusiastic about it and she would take too much of our time. I will say that the end results are most gratifying. I believe that the amount of expense is negligible considering the results that are obtained.

**Dr. I. S. Tassman** (closing): I would like to state that I had in mind particularly the conduct of a clinic in its association or connection with the regular eye clinic in the average hospital. I believe that cases should be selected for orthoptic training or those that are sent to the orthoptic clinic. There is no use in sending children who have such a low mentality that we can decide in the very beginning that orthoptic exercise will prove of no avail. Or the ophthalmologist might decide it is even useless to bother the orthoptic clinic with those cases that might be called squint cases and present too great an angle of deviation.

I think I did enumerate a number of different essentials or accessories that might be improved in a clinic; for the

(Concluded on page 252)

# ARCHIVES of PHYSICAL THERAPY

## OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

### .. EDITORIALS ..

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#### IMPORTANT ROLE OF PHYSICAL THERAPY IN THE NATIONAL DEFENSE PROGRAM

The weal of our country as well as the health of its people are of prime interest to every citizen and every human who has sought protection or sanctuary within its border. As physicians we have long shouldered this double duty with all the pride and zeal of an obligation born of eternal love for hearth, home and humanity. No other group has responded more unanimously and more wholeheartedly to the danger of war clouds abroad which threaten our common way of life than did the medical profession at the last annual session of the American Medical Association, in New York. No one within this large body of diversified specialists rose more spontaneously to the call of our Government and national organization than did the members of the American Congress of Physical Therapy and the Society of Physical Therapy Physicians. Yet sad to recall are the events that have succeeded this initial response under the enervating policies of interlocking opinions emanating from short-sighted and misinformed directors.

Nearly twelve precious months have passed and physical medicine finds itself today in a cul-de-sac relegated thereto by well intentioned officials who unfortunately either have been bound down by the web of red tape or concomitant responsibilities that has made routinism the easiest way out to an unfamiliar problem. Organized medicine failed to recognize the place and responsibility of physical therapy in the scheme of reconstructive service in national defense and official Washington in its apparent unawareness of the historic role played by this specialty in the last World War, has in a sort of somnolent fashion made an executive gesture which if carried out promises to reduce this positive therapeutic practice to a futile state. This situation with reference to the relation of physical medicine to national defense is therefore so confusing and its present status in the scheme of organizational recognition so negligible that little is to be wondered at the growing apathy, indifference and discouragement now evident within its rank.

To be more concrete about what has been stated it should be recalled that when the Government undertook to cooperate with the American Medical Association for the evident purpose of utilizing the available medical resources of the nation in order to insure the greatest possible usefulness and effectiveness of medicine in national defense, our parent organization elaborated a questionnaire dealing with every known specialty except that of physical medicine. Efforts have been made, as no doubt many will recall, to invite the serious attention of responsible quarters to this flagrant oversight, but if any cognizance has been taken of the published protests no officer of the American Congress of Physical Therapy has been officially so informed. This failure on the part of a national body to recognize the existence of a specialty it has sponsored and encouraged for many years does not relieve the Surgeon General of the Army and the head of the Bureau of Medicine of the Navy from the responsibility of their own initiative in providing the armed forces with that branch of medical service whose value both therapeutic and economic has been so clearly demonstrated during and

after the first World War that it would seem to have earned official military and naval recognition alongside of other important specialties.

While American ingenuity supposedly is sufficiently developed to solve any and all problems of national defense, no true leader can afford to ignore the experiences gained by the military of other nations, be they allies or opponents. Students of military medicine know the value of the services rendered by the medical profession of Germany to the land forces during the active campaigns which began with the invasion of Poland, continued toward the Western littoral, and is still being maintained in the mountainous terrains of the Balkans. There is ample evidence in the contemporaneous literature emanating from foreign sources that the highest military leaders have acknowledged the tremendous role in the conservation of man power that has been played by physical therapy in the war hospitals with particular reference to the restoration of many wounded for whom the otherwise excellent service of the various branches of surgery have proved inadequate in the sense of restoring many to the combatant forces. Great Britain, too, is fully aware of what is needed to be achieved by its medical personnel beyond the control of infection of wounds in order to restore casualties to the front line at the earliest possible moment and in the greatest possible number.

So far as the present situation is concerned it should not be forgotten that war is no longer fought solely by armed forces on battlefields of their choosing, but involves every man, woman and child residing within the boundaries of nations at war. That, today, has been accepted as an objective to which has been given the name, "total war." This being so it is the solemn duty not only of the military but also of the civil authorities to conserve national health to the greatest degree attainable by scientific medicine, and in this all measures aimed at restoring the incapacitated to lives of economic usefulness represent a problem of national weal which can no longer be ignored. There is a saying that in times of peace a nation should prepare for war. This rather trite adage should be augmented by another adage; namely, to prepare in time of war for peace — peace in the sense of productive power of the whole citizenry. That is one of the missions of modern physical therapy. Can all those in authority ignore such facts without incurring the risk of being penalized for failure to look beyond the immediate needs of our population in times of a major emergency such as we are confronting today? Failure fully to avail themselves of the tremendous resources offered by physicians especially trained in the proper practice of physical medicine precisely means incurring such a risk.

The American Congress of Physical Therapy is a national body of ethical physicians that seeks no special privileges over others, but demands as a matter of justice to the youths who have been drafted by the Government for national defense the humanitarian and civic right to vouchsafe them the best possible medical service in the event of disabilities incident to war trauma. This is a solemn duty of the Government, a duty which is to its own interest, because the present sacrifices of our soldiers and sailors, to say nothing of innocent civilians, entitle them to the protection of the Government to the extent of human possibility. In this program of adequate service physical therapy will not only lessen human suffering but reduce the effects of mutilation to the minimum.



## ROUND TABLE INSTRUCTION COURSE

In accordance with the precedent set up by the past programs of annual sessions of our Congress, this year, again, is presented an instruction program so well rounded out in timeliness of subject matter and balance of its teaching faculty that it truly can be said to be one of the most important of didactic courses offered to the profession and their technical assistants. As in past sessions, this instruction course will be presented or offered in conjunction with the twentieth annual scientific and clinical session of the Congress on the mornings of September 2 to 5 at The Mayflower in Washington.

At the annual meeting of the Congress last year, it was agreed that it would be advisable in the future to arrange the instruction course so that two types of lectures would be available, elementary and advanced. It was also felt advisable to arrange the course so that there would be less electives and less duplication of training and so that the lectures would be better correlated and more progressive in nature.

With this thought in mind, the Committee has arranged a tentative schedule which provides an elementary course, lectures E1 to E12. This elementary course progresses in orderly fashion through descriptions of local applications of heat, general applications of heat, infra-red radiation, ultraviolet radiation, low voltage currents, high frequency currents, hydrotherapy, massage, corrective exercise, occupational therapy, clinical aspects of physical therapy and administration of a physical therapy department.

In addition to this correlated, progressive, elementary course, the Committee has arranged to present three advanced courses. The first advanced course, (AF1 to AF12) deals with the advanced fundamental aspects of physical therapy. This course will include descriptions of the physics of heat therapy, the physics of light therapy, the physics of electrotherapy, sources of heat radiation, sources of ultraviolet radiation, sources of low voltage and high frequency currents, physiologic effects of heat, physiologic effects of ultraviolet radiation, physiologic effects of hydrotherapy, physiology of massage and exercise, research technic in physical therapy and correlation of fundamental and clinical aspects of physical therapy.

The second advanced course (AC1 to AC12) will deal with the clinical aspects of physical therapy and will discuss in an orderly fashion physical therapy in relation to internal medicine, physical therapy in relation to surgery, physical therapy in relation to orthopedics, physical therapy in relation to arthritis, physical therapy in relation to dermatology, physical therapy in relation to otorhinolaryngology, physical therapy in relation to pediatrics, physical therapy in relation to neurology, physical therapy in relation to urology, physical therapy in relation to obstetrics and gynecology, physical therapy in relation to proctology and physical therapy in relation to industrial medicine.

The third and last advanced course (AG1 to AG12) will deal with general aspects of physical therapy which past experience has shown us are of particular interest to physicians. This course will include lectures on occupational therapy, physical therapy in amputations, physical therapy in cerebral palsy, physical therapy in poliomyelitis, fever therapy, cryotherapy, operation of the hospital physical therapy department, physical therapy in peripheral nerve injuries, corrective exercises, physical therapy in management of low back pain, physical therapy in management of fractures and physical therapy in general practice.

Applicants for the course may select any lecture desired during any particular hour. It is advisable for individuals who have had little previous



experience with physical therapy to follow the elementary course throughout. Individuals who have attended previous courses will probably wish to select one of the three advanced lectures. Wherever possible, it would probably be best to follow one of the set courses throughout, although this is not essential. A tentative schedule and a tentative list of the faculty for the 1941 course is presented on pages 196 and 197.

#### SECTION MEETINGS OF THE CONGRESS

While the main annual event in physical therapy takes place with the session of the Congress, the regional meetings though short in time and limited in their resources nevertheless are deemed of great importance not only by the concerned participants but by all interested in physical medicine. It is for this reason that the brief comments on three such meetings are of more than local interest.

The *Southern Section* which comprises the States of Texas, Oklahoma, Louisiana, Arkansas and Missouri will meet at the Worth Hotel, Fort Worth, Texas, on May 12 next, which immediately precedes the convention of the Texas State Medical Association. All ethical physicians and vouched for physical therapy technicians are invited to register at eleven forenoon. The scientific program proper will be opened immediately after lunch and continue throughout the day, with the exception of one hour of entertainment being provided in connection with a dinner. Serious efforts have been made to secure a program dealing with a variety of problems of physical therapy. A particular feature which should elicit considerable interest is a quiz conducted by Dr. Euclid Smith, of Hot Springs, Arkansas during which any and all participants may propose questions and answers in the form of an open forum. Authoritative addresses will be given by Drs. Nathan Polmer, of New Orleans; O. B. Kiel, of Wichita Falls; Vernon Newman, of Little Rock; C. F. Clayton and H. P. Radtke, of Fort Worth; P. M. Girard, of Dallas; J. W. Torbett, of Marlin; E. Goldfain and J. Hubbard, of Oklahoma City; H. E. Hipps, of Marlin, and other outstanding men in our field. With such a program to be presented at an auspicious moment for southern medicine this regional meeting should prove one of the most successful and profitable for all.

The *Eastern Section* held a noteworthy session in New York City on April 5, and in spite of bad weather and martial festivities preceding Army Day proved one whose scientific spirit was not dampened. Indeed, it was commonly commented by many participants that the program, for the arrangement of which Dr. Madge C. L. McGuinness deserves the lion's share of credit, was one of the most substantial and stimulating ones that had been presented at that numerically largest of sections, enhanced by the memberships of the physical therapy societies of New York, Pennsylvania, Connecticut and New Jersey. Nine papers were presented at that session throughout the afternoon and evening, all of which were of a high order and based on new and original observations and studies. They were ably discussed by physicians who had come from near and far to share in this mental feast. As most of the papers will eventually be published in the ARCHIVES our readers will benefit from that eventful gathering of our eastern colleagues.

The *Midwestern Section* held its annual spring session in the auditorium of the University of Wisconsin Medical School, in Madison, on April 16, differing from the other regional meeting therein that the program was carried through from ten in the morning until the early evening, so that it was a daylight convention, which, like the eastern one was held under unfavorable weather conditions. This program opened with a paper on muscular atrophies (Bennett, of Madison).

(Concluded on page 246)

# SCIENCE, NEWS, COMMENTS

## New Jersey Society of Physical Therapy Physicians Meeting

The monthly meeting of the New Jersey Society of Physical Therapy Physicians was held February 27, 1941 at St. Mary's Hospital in Passaic, N. J. The following scientific program was presented:—

1. "Medicolegal Responsibilities of the Physician," *Joseph Rubacky, LL.B., M.D., Passaic, N. J.*
2. "Artificial Fever Therapy—Indications and Results," *B. S. Troedsson, M.D., Orange, N. J.*

The March meeting was held at Jersey City Medical Center, and the April session will consist of a participation in the Eastern Section Meeting of the American Congress of Physical Therapy in New York City.

ROBERT F. DOW, M.D., Secretary.

## Pennsylvania Physical Therapy Society Meeting

A combined meeting of the Philadelphia Orthopedic Club and the Pennsylvania Physical Therapy Society will be held at the Jefferson Hospital Amphitheatre, Philadelphia, Thursday, April 10, 1941 at 8:30 p. m. The following program will be presented:

1. The Value of a Physical Therapeutic Department to the Orthopedic Surgeon. *William H. Schmidt, M.D. (20 min.)*

Discussion by *Rutherford L. John, M.D. (5 min.)*

2. The Early Treatment of Infantile Paralysis. *A. M. Rechtman, M.D. (20 min.)*

Discussion by *Josef B. Nylén, M.D. (5 min.)*

3. Memoirs of Dr. DeForest Willard. *DeForest P. Willard, M.D. (15 min.)*

4. Physical Therapy in Relation to Peripheral Vascular Disease of the Extremities. *Robert P. Sturr, M.D. (20 min.)*

Discussion by *C. Howard Moore, M.D. (5 min.)*

5. Physical Therapy in the Treatment of Arthritis. *A. A. Martucci, M.D. (20 min.)*

Discussion by *W. T. Johnson, M.D. (5 min.)*

6. Treatment of Sciatica. *Benjamin Ulanski, M.D. (10 min.)*

EARL ROTHERMEL, M.D., President.

ALBERT A. MARTUCCI, M.D., Secretary.

## Meeting of Section on Physical Therapy, Medical Society of County of Kings

The next regular meeting of the Section on Physical Therapy of the Medical Society of the County of Kings will be held in the Medical Society Building, 1313 Bedford Avenue, Brooklyn, N. Y., Thursday, May 8, 1941, 8:30 p.m. sharp. The program will be as follows:

1. Physical Therapy in Plastic Surgery, *Walter A. Coakley, M.D., St. Mary's Hospital.*

2. Physical Therapy in Ophthalmology, *Frank W. Mallon, M.D., St. Mary's Hospital.*

3. Physical Therapy in General Practice, *Saul Starr, M.D., Israel Zion Hospital.*

The medical profession is cordially invited.

## Annual Session of American Academy of Physical Medicine

The American Academy of Physical Medicine will hold its Nineteenth Annual Meeting and Scientific Session on April 28, 29, 30, 1941, in New York, with headquarters at the Hotel Pennsylvania, where lectures, symposia, clinical papers, motion pictures, and the exhibits will be presented. All members of the medical profession and those of related interests are invited to attend the scientific program. There will be no registration fee. Address inquiries to Herman A. Osgood, M.D., Secretary, 144 Commonwealth Avenue, Boston, Massachusetts.

## Ultraviolet Inspection Lamp

Designed for cataract surgery, this lamp is a bulb type mercury vapor (ultraviolet) lamp with special filter, contained in a parabolic reflector with pistol grip for convenience in manipulating. It projects a full beam of ultraviolet light of a maximum intensity at 3650 Angstrom units, which, when directed into the eye will cause the crystalline lens to fluoresce.

The lamp is described as useful for the identification of cortical residue or remnants of capsule following extra-capsular cataract extraction, to visualize the anterior capsule of the lens in intra-capsular extraction, to locate dislocated lenses, to recognize fine, superficial, corneal abrasions stained with fluorescein without the use of a corneal microscope or slit lamp, to detect slight lesions of the lid, more or less imperceptible by ordinary light.

## Gunshot Wounds Mortality Remains at World War Level

Men shot in the abdomen have no better chance of surviving today than they had during the first World War, despite improvements in the surgeon's technic.

Higher powered ammunition in use today is the reason, Dr. Elkin L. Rippey, Nashville, Tenn., surgeon, declared at the meeting of the American Medical Association in New York City.

Army surgeons will find blood banks more valuable than x-ray machines for handling such wounds, he suggested. Taking time for x-rays to locate the bullet probably does more harm than good because of the delay involved. Blood transfusions are especially valuable because the greatest single factor in death from gunshot wounds is the amount of blood lost. Of 112 injured who had severe hemorrhages, 83 per cent died.

Gunshot wounds of the abdomen remain the most effective method of killing, he has found. Although his studies were made in peace, he reminded fellow surgeons they may soon be faced with the job of caring for gunshot wounds of war "since at the present time over half the world is engaged in war and the peace of the rest of the world hangs by a thread."

An increase of 20 per cent in the velocity of the bullet in the past 25 years makes it cause more damage to abdominal organs, he said. The smaller the caliber of the rifle or pistol, the lower the mortality, Dr. Rippey found, from investigating 292 cases of gunshot wounds of the abdomen occurring in Nashville between 1923 and 1939. Most of the shotgun cases were attempted murder, with guns shot at close range and tearing holes so large it was almost impossible to repair the damage.

The increased velocity of modern bullets which causes so much damage is beyond the control of the surgeon, but Dr. Rippey pointed out five factors making for the recovery of the wounded which the surgeon can control. These are: Prompt operation — the earlier the victim is operated on the greater his chance for recovery; choice of anesthetic; operative technic; length of time taken for the operation; and care before and after operation.—*Science News Letter*.

#### Turntable for Cancer

Patients suffering from cancers deep within their bodies are expected to be helped by a turntable apparatus devised by Dr. S. J. Hawley, of the Geisinger Memorial Hospital, Danville, Pa.

While X-rays are being used to destroy the cancer, the patient lies on a turntable which rotates him during the treatment. The X-ray beam is aimed directly at the cancer, but the rotation of the patient causes the beam to spread over the large skin area which continually moves in the beam. This

avoids damage to the skin without sacrificing cancer-destroying dosage of the X-rays. Before invention of the turntable device, physicians tried to avoid skin damage by aiming two, three, four or more X-ray beams at the cancer through separate areas of the skin. — *Science News Letter*.

#### Our Error

*To the Editor*—In the March number of your valued publication (Vol. 22, March, 1941, No. 3) there appears on page 187 an abstract of my article which is entitled "Electrosurgical Obliteration of the Gallbladder Without Drainage" which appeared in the Illinois Medical Journal (78-211, September 1940). In this abstract appears the following incorrect statement:

"Electrosurgical cholecystectomy—electro-cholecystectomy—so-called is a refined procedure wherein the electric cutting knife is substituted for the scalpel."

Such statement does not appear in my original article. On the contrary, in my article in the Illinois Medical Journal, I stated as follows:

The operation here described must not be confused with Pribram's mucoclasia practiced with the cautery or by 'diatherm-fulguration' which aims at 'burning' or 'carbonization' of the mucous membrane of the gallbladder wall or with so-called 'electrical' or 'electro-cholecystectomy', where, instead of the scalpel, the diatherm cutting knife is used. These are entirely different procedures.

Since the abstract carries an entirely different thought from that intended to convey in the original article, I respectfully call this to your attention and I feel confident you will see the necessary correction is made in order to avoid misinterpretation.

DR. MAX THOREK.

*Comment*—The Editor acknowledges an inadvertent error.

#### Section Meetings of the Congress

(Continued from page 244)

was continued by such important problems as the physiology of heat (Molander, of Chicago); infra-red effect on cutaneous temperature (Elkins, of Rochester, Minn.), applications of local heat (Krusen, of Mayo Clinic); Kenny treatment of poliomyelitis (Knapp, of Minneapolis); therapy of nerve injuries (Coulter, of Chicago), and concluded with a review of short wave diathermy (Schmitt, of Chicago). Many of these papers elicited lively discussions so that all in all the midwestern section had a profitable day devoted to the scientific interests of physical medicine.



## THE STUDENT'S LIBRARY

APPROVED LABORATORY TECHNIC. CLINICAL, PATHOLOGICAL, BACTERIOLOGICAL, MYCOLOGICAL, PARASITOLOGICAL, SEROLOGICAL, BIOCHEMICAL AND HISTOLOGICAL. By *John A. Kolmer*, M.S., M.D., Dr. P.H., Sc. D., LL. D., L.H.D., F.A.C.P., Professor of Medicine, Temple University, Director of the Research Institute of Cutaneous Medicine, Philadelphia, etc., and *Fred Boerner*, V.M.D., Assistant Professor of Bacteriology, School of Medicine and Graduate School of Medicine, University of Pennsylvania; Bacteriologist, Graduate Hospital, Philadelphia. Cloth. Pp. 921 with 380 illustrations. Third Edition. Price, \$8.00. New York: D. Appleton-Century Company, 1941.

No less than twenty-eight of America's leading clinical pathologists have contributed to the perfection of this encyclopedic work, which within ten years required three revised editions in order to keep the data down to date. The word "approved" in the main title indicates that the laboratory methods described have been standardized by prominent members of the American Society of Clinical Pathologists, and it is believed that the technics advised may result in more uniform and more reliable results than has been the case in the past in many instances. The subtitle indicates the scope of the book, and if it is added that the presentation of the material required no less than thirty-eight chapters exclusive of material given in an appendix of 26 pages, then one can realize that the field has been covered in its entirety. What is perhaps even more praiseworthy is the fact that there is not the least evidence of padding, the formulae and directions for tests, be they quantitative of urine or methods of experimental inoculation, being given in simple, terse and lucid language, leaving no room for uncertainty or possibility of misinterpretation. It also becomes evident that this is a treatise for laboratory workers, but as many physicians are compelled to make their own urine, blood, gastric contents tests, examine excreta and often undertake even tests for allergy, to mention only those most commonly resorted to in everyday practice, this book will prove of great help as a guide to the latest and most reliable methods of laboratory examination. Again, while many of the tests are very complicated and require special equipment, many more are comparatively simple and carried out with equipment which any successful practitioner desirous of being precise in his diagnostic methods can acquire without great expenditures. When the reviewer feels that he does not exaggerate by stating that the book is actually the last word in diagnostic technics carried out in laboratories, then further praise would seem superfluous. Print, illustrations, paper and binding also leave nothing to be desired. To many this is a "must" book.

SCIENCE ON PARADE. By *A. Frederick Collins*, Fellow, Royal Astronomical Society. Cloth Pp. 314. Price, \$3.00. New York and London: D. Appleton-Century Company, 1940.

This book comes from the pen of the same popular expositor who has listed to his credit the authorship of 35 volumes dealing with some phase of science utilized in modern civilization. The text under consideration deals with the progress of science and attempts to present in non-technical language a sweeping and dramatic picture of the advances made in at least a dozen separate fields. How sweeping this review of science on parade is, can be indicated by the subjects covered in this contribution. A moderately long foreword bridges the gap between the present era and that initiated by Roger Bacon, the pioneer of the modern method of scientific reasoning, who was responsible for introducing an attitude from things implicit to things explicit. Within this period of over three centuries science has grown to such proportions and has so transcended the most optimistic prophesies, that only the broadest hints can be catalogued of its swift and spectacular strides and its influence on the world of today. When one remembers that no less than ten different kinds of electric lights were used to illuminate the Century of Progress Exposition in Chicago, and that the display of its multifold uses and meanings were presented by the most recent of American expositions in the New York's World of Today and Tomorrow, it is a bit amazing that the average individual accepts the presence of radio—telegraph, telephone and therapeutics—not to say moving pictures and the airplane, with a placidity of mind that is little if not astonishing. In this era and in this very decade one has witnessed the birth of the photoelectric cell or electric eye, and has accepted the stunt of lighting an exposition with the light that traveled 40 years from the giant star Arcturus. Today, one even is taking for granted the spectacular action of television, the cathode ray, and civilization will not as much as pause in its stride of self destruction despite the discoveries foreshadowed in the things to come. This is the purpose of this entertaining and thought provoking book. It provides an instructive evening full of surprising diversions of an informative and interesting character. In eleven chapters the author reviews science on parade by evaluating the advances in astronomy, aviation, chemistry, electricity, health, light, music, photography, radio, synthetic speech and television. Collins has an especial talent for presenting his data in vivid colors and in lucid diction. The book is comprehensive, educational and timely.



THE 1940 YEAR BOOK OF GENERAL THERAPEUTICS. Edited by *Oscar W. Betha*, Ph.M., M.D., F.A.C.P., Professor of Clinical Medicine, Tulane University School of Medicine, etc., etc. Cloth. Pp. 545 with 47 illustrations. Price, \$2.50. Chicago: The Year Book Publishers, Inc., 1940.

Despite the festive colored jacket which signifies the advent of the 40th anniversary of the Year Book series and a preface that attempts to give proper perspective and historic significance to the evolution of this most valued publication, this volume on general therapeutics is a silent but sad testament of a loss that may be replaceable but hardly repairable. With all due respect to the known scholarship and obvious leadership of Dr. Betha, the successor to the mantle that fell from the tragic shoulders of that most lovable and erudite personality, the late Dr. Fantus, the medical profession at large will find it difficult to forget the past contributions of the latter or to dissociate his name from any future volume issued by the publishers of this special volume with which his name has become a synonym for all that is constructive and informative in a medico-literary sense. As we feel the void of his untimely passing we nevertheless are pragmatic to offer his successor the best wishes in a task whose standards are so high that it is a challenge that only the best qualified can meet. The choice of Dr. Betha is a happy one, for no one is more fitted to carry on the tradition of the high standard set for him than he himself. We wish him a long and happy tenure and assure him the same constructive support that his editorship will be certain to elicit.

No more practical volume in therapeutics is to be found in contemporary medical literature that specializes in the selection of current information on this subject. The editor is to be felicitated on a highly informative and well balanced contribution and the profession to be congratulated at its opportunity to obtain the widest range of information of an essential and special character. Space will not permit a detailed analysis of the wide range of subjects and therapeutic suggestions covered in this volume. The editor has been influenced in the selection of material for this volume by what he wanted in his greater wisdom and wider experience to find in such a year book. For the general practitioner or specialist, we insist that this volume contains more vital and timely information per square inch than any similar volume in our language. It is a "must" book that should be thumbed at all hours for the nuggets it will elicit.

NATURHEILKUNDLICHE BEHANDLUNG VON HERZKRANKEN. ELEKTROKARDIOGRAPHISCHE STUDIEN (NATUROPATHIC TREATMENT OF HEART PATIENTS, ELECTROCARDIOGRAPHIC STUDIES). Von Dr. med. et phil. *Franz Kienle*, Assistant at the Medical Clinic of the Rudolf-Hess-Hospital, Dresden. With an Introduction by Professor Dr. *L. R. Grote*, Director of the Medical Clinic of the Rudolf-Hess-Hospital, Dresden. Paper. Pp. 155 with 145 illustrations. Price, Rm. 9. Dresden and Leipzig: Theodor Steinkopff, 1940.

It is regrettable that an intrinsically scientific monograph as the one here to be reviewed is forced no doubt to the regimentation of medical science to announce an objective with which ethical medicine cannot be associated. Reference is had to the statement that the small book intends to show by electrocardiographic and clinical (subjective) proof that certain heart conditions do better under so-called naturalistic than scientific medicine. The word "Naturheilkunde" at least in Germany implies any form of drugless healing by laymen without any claim to regular training in medicine or for that matter any training at all. As a rule the practices consist of all sorts of hydropathic measures, dietetic absurdities, mechanotherapy according to methods advocated by each claimant to special healing ability. Under the circumstances it is clear that there exists a certain vague relation to physical therapy, to which the author could very well have restricted his observations. Perusal of the clinical reports of a number of patients afflicted with cardiorenal diseases reveals that in the main the treatment afforded them consisted of rest in bed, limitation of food to fruit juices for a few days followed by a dietetic restriction to uncooked foodstuffs. In this the booklet offers nothing especially new since it is generally appreciated that many cardiac affections do better under bed rest and dietetic restriction than under medication with digitalis or strophanthus. In America the name of Weir-Mitchell has long been associated with the therapeutic value of rest, even though his first observations were limited to neuroses and psychoses, while more recently Edmund Jacobson (*Archives*, November, 1940) has scientifically proved the value of relaxation in hypertension. Nevertheless, if one ignores the purpose of Kienle's effort, his studies may be accepted for collateral reading on the problems of physical therapy with relation to a variety of affections of the circulatory and renal apparatus.





# INTERNATIONAL ABSTRACTS

## Physical Medicine in Industry and War. I. Gunzburg.

Brit. J. Phys. Med. 3:168 (Sept.) 1940.

The purpose of occupational therapy is to re-establish functional capacity to injured workmen, after the healing of their wounds, by means of surgical aid, massage, and mechanotherapy. When the physiotherapeutic treatment has restored some degree of mobility and muscular tonicity, the aim is to enable the patient to acquire enough manual ability to take up his usual work again. Gunzburg has devised the following progressive system:

1. Lowering of the arm, carried out by means of the hammer, the hatchet, etc. The exercise selected is hammering of nails, which affords an easy gradation. At first only the point of the nail is hammered, then, the whole of it. Finally the patient has to bring several planks together, over each other or at right angles with each other, acute angles, etc., so as to build geometrical models. These exercises assist suppleness of the wrist and elbow, and they re-educate fine movements of the hand.

2. For traction, nippers, spades, etc., are used. The exercises consist in pulling nails out of one or several planks, and in bending iron wire into an ellipse, circle, or spiral. The flexors of the hand and the extensors of the forearm are thus strengthened.

3. A third movement requiring re-education is rotation, in the vertical position, of the arm. Screwdrivers, compasses, chisels, and boring tools allow an easy gradation. The exercises are gradually made more complex. This work, combining supination with pronation and pressure, makes the wrist and elbow supple, is important for the thumb's opposition, and increases the strength of the fingers.

4. Propulsion is employed in joinery by means of the chisel, the spokeshave, etc., also the movement of pushing a barrow. With the help of a wooden hammer, the straight chisel is employed to cut out notches of various shapes. With the help of the hammer, or even without it, the plain chisel allows the cutting out of fretwork.

5. The sawing movement provides an advanced stage in the transition to professional work. The vertical saw needs an effort of the whole body, and is a very good exercise for the arm and the shoulder.

## Use of Ultraviolet Light in Preparing a Non-Virulent Antirabies Vaccine. H. L. Hodes; L. T. Webster, and G. I. Lavin.

J. Exper. Med. 72:437 (Oct. 1) 1940.

There is general agreement that virulent rabies virus administered to animals in proper doses is capable of immunizing them against a subsequent

test infection. It is thought by many observers, however, that prophylactic vaccination of a dog population with virulent vaccine is dangerous both in theory and practice. Consequently efforts have been made to devise an effective yet harmless vaccine.

Ultraviolet light has been shown to render neurotropic viruses, including rabies, avirulent with accompanying loss of immunizing potency but the authors' tests are the first to show that by proper exposure of virus to ultraviolet light virulence may be destroyed and immunizing potency retained. The experiments point out that ultraviolet light may be used as a readily controllable agent to render virus non-virulent without destroying its immunizing capacity. Whether such a vaccine is superior to chloroformized vaccine and whether it immunizes dogs in practical doses are points which are now under investigation. The question of whether the irradiated virus owes its immunizing potency to undetected remnants of virulent virus, cannot be answered beyond stating that vaccines containing some, but less than 1 m.l.d. of virulent virus immunizes no more effectively than those containing too detectable virulent virus, and that if virulent virus alone is employed as a vaccine, at least 160 to 1,600 m.l.d. are required to produce a demonstrable immunity.

## Vascular Lesions of Extremities. Paul G. Flothow.

Western J. Surg., Obstet. & Gynec. 48:333 (June) 1940.

Flothow presents 10 points in the prevention and treatment of vascular lesions of the extremity. This incorporates recommendation of many measures and warnings against their abuse; namely: (1) Extreme care in hygiene of the feet, and avoidance of trauma. (2) Certain postural exercises, such as alternate elevation and lowering of the extremities to empty and fill the blood vessels. (3) The use of contrast baths, alternating in hot and cold water. (4) Physiotherapy. Diathermy should be avoided as it has certain dangers. The infra-red light, quartz light and gentle heat in any form are of distinct value, but often more harm than good is done by the application of excessive heat. (5) Intravenous hypertonic saline injections. (6) Fever therapy produced by vaccines, foreign proteins and inductotherms may be of value in some cases. (7) Vasodilating substances are of value where vasospasm is present, but their effects are transient. (8) Iontophoresis, which is the direct introduction of vasodilating drugs into the extremity by means of an electric current, is not widely applied. (9) Passive vascular exercise (Paevex). This is an apparatus which alternately produces positive and negative pressure on the extremity

to empty and fill the vessels mechanically. (10) Intermittent venous occlusion. This form of therapy has now entirely superseded the Paevex and is at present very popular. Within a few years it will probably follow Paevex into oblivion, and some other "gadget" will take its place.

#### **Vocational Rehabilitation of the Tuberculous.** **Grace H. Carlson, and Donald H. Dabelstein.**

Am. Rev. Tuber. 40:674 (Nov.) 1940.

Although within recent years there has been recognition of the need for adequate after-care and vocational rehabilitation of discharged tuberculous patients, the development of adequate facilities for such services has not kept pace with or paralleled medical progress in the treatment of this group. The vocational rehabilitation of the tuberculous has not only been grossly neglected, but many of the attempts have been carried on in a haphazard, incidental manner by untrained personnel. It is the opinion of the authors that applied psychology should focus its attention upon the necessity for scientific study of the vocational adjustment of these individuals and that in this field lies an opportunity for psychologists to contribute to the conservation of human resources.

The most extensive program of vocational rehabilitation of the tuberculous in Minnesota has been developed at Glen Lake Sanatorium. Superior sanatorium facilities are supplemented by an educational program carried on by the Adult Education Department of the Minneapolis Schools.

The rehabilitation program at this institution is based on the assumption that rehabilitation of the tuberculous is a complex process involving the total welfare of the individual. A person who enters the sanatorium is more than a diseased patient. His social, economic, mental and spiritual needs continue as before. The process of vocational rehabilitation begins as soon as the patient has recovered sufficiently to engage in some activity. The rehabilitation planning is carried on through the staff clinic in order that all of the patient's activities may be directed toward a vocational goal.

#### **Effect of Ultraviolet Radiation on Roentgen Rays:** **Do Ultraviolet Rays Have Deleterious Effect on** **Roentgen Rays When Applied to the Skin?** **F. A. Ellis, and H. Kirby-Smith.**

Arch. Derm. & Syph. 42:399 (Sept.) 1940.

Ellis and Kirby-Smith believe that the former lack of adequately accurate measurements of dosage, mistakes in technic and overdosage are the main causes for roentgen ray sequels and not a concomitant actinic dermatitis or/and a dermatitis due to external irritants. The combined application of roentgen rays and actinic rays should be repeated with all factors controlled by modern methods and standards of measuring dosage. In 1939 they examined eleven patients who had received from ten to sixteen one-third erythema doses of roentgen rays and four to twenty-one

erythema doses of ultraviolet rays. All of the patients applied a two ply acne lotion to the treated areas. The time from the termination of treatment to the reexamination was from three to eight years. Nine patients have had subsequent roentgen and actinic ray therapy. None of them showed any evidence of roentgen ray dermatitis; in fact, in half of them there was an excess of facial oil and in the majority some acne lesions still developed. The authors have replaced this routine of therapy during the last few years by a technic of giving approximately 70 roentgens weekly. They have continued to use the modified white lotion concurrently, without any evidence of roentgen ray sequelae. In their opinion the roentgen therapy has simply an additional action on actinic effect on the skin; for instance, if R represents the permanent or late roentgen ray effect and A the permanent actinic cutaneous change, then the total late changes will equal R plus A. When R and A are given simultaneously, alternately or later, neither exerts a beneficial or deleterious action on the other, but only a summation of one plus the other. — [Abstr. J. A. M. A. 115:1403 (Oct. 19) 1940.]

#### **Electrical Convulsion Treatment of Mental Disorders.** William Furst.

J. A. M. A. 115:1821 (Nov. 23) 1940.

In the editorial in *The Journal*, August 10, on "Electrical Convulsion Treatment of Mental Disorders," credit was accorded to Cerletti for first utilizing the electric current in 1937 to induce epileptic seizures in animals. I should like to call attention to a paper by Clark and Wall [Unconsciousness Produced by Electric Currents, *Quart. J. Exper. Physiol.* 24:85 (Feb.) 1934] which states that in 1900 Ledue, by applying certain types of current to an animal's head, produced a fit with loss of consciousness varying in degree from a condition resembling sleep to one of deep coma and loss of reflexes but without causing any permanent damage to the animal.

Robinovitch (Sommeil électrique, Nantes, 1906) also described a condition in animals which she called "épilepsie électrique" and in which loss of consciousness was associated with many features characteristic of the epileptic fit. Weiss [*Bull. Soc. Internat. des Elect. Paris* 1:417, 1911] and Hess [*Compt. rend Soc. de biol.* 107:1333 (Aug. 5) 1931] confirmed these results.

Clark and Wall showed that (1) animals displayed no fear of repeated shocks and seemed quieter and more docile for a considerable time after treatment; (2) an initial fall in blood pressure occurred which was abolished by section of the vagi; (3) by direct observation through a window in the skull the cerebral vessels were constricted, followed by dilatation after the current was switched off, and (4) direct cerebral stimulation and not vasoconstriction of the cerebral vessels was responsible for the convulsions, since stimulation of the proximal end of the cervical sympathetics, while producing vasoconstriction, did not elicit an epileptiform seizure.

I trust that these references will add to the experimental background of the electroconvulsive therapy.

#### **Cardiac Output in Rest and Work in Humid Heat. Erling Asmussen.**

*Am. J. Physiol.* 131:54 (Nov. 1) 1940.

Acclimatization to humid heat seems to involve such regulations that the circulation in rest and during work in a steady state can be kept at a practically normal level. A blood volume increased by about 5 per cent and a slightly higher pulse rate are assumed to be the two main factors in this regulation. Circulatory failure during work develops rather fast in humid heat owing to the fact that the thermal dissipation is made difficult. A larger amount of blood is demanded for the skin circulation, making maintenance of an adequate cardiac output increasingly difficult.

#### **Sanatorium Treatment of Tuberculosis. I. D. Bobrowitz.**

*Dis. of Chest* 6:278 (Sept.) 1940.

The treatment of tuberculosis is not complete until the patient is free of all active disease and in a satisfactory economic situation, and thus the need for rehabilitation. Rehabilitation represents activity, either physical or mental, that not only aids in the recovery from tuberculosis, but also assists in the adjustment of the individual to a new economic status. It involves a gradual increase in exercise and work by the patient and is ergo therapy.

Rehabilitation covers a multitude of forms and needs, and includes many subjects, such as commercial (stenography, clerical, typewriting); various arts and crafts (printing, bookbinding, photography, wood, metal and leather work, carpet making, reed weaving) and miscellaneous occupations like laboratory technician, barber, tailor, gardener and farmer.

The general plan in associating patients with rehabilitation is to grade the patients' physical activity, and in this manner the work is constantly under the direction of the physician. The occupational therapist guides the choice of work by consideration of the educational background of the patient, previous work experience, mental attitude, occupational inclinations and interest and manual dexterity. In more complete programs, a very thorough aptitude test is done to determine the occupation the patient is best suited for. In this a psychologist aids the therapist.

As the patients continue to improve, the activity and time allowed for occupational therapy is gradually increased so that on discharge, they are performing the equivalent of four or more hours' work a day.

The desirability of rehabilitation is emphasized by the fact that tuberculous patients are young enough, well enough and intelligent enough to receive skilled training, and there is a particular

need for teaching new vocations. To aid in the return to industry, sanatoria are associated with welfare employment agencies, state job placement bureaus or sheltered work shops.

Although the work taught in a sanatorium may not always be of a type directly applicable by the patient for return to an outside occupation, all work performed is definitely useful because it aids and speeds recovery, improves the physical condition of the patient, serves as a hardening process, provides mental stimulation, promotes individual contentment and actually teaches new skills.

#### **Infantile Paralysis. Charles W. Burhans.**

*Ohio State M. J.* 36:865 (Aug.) 1940.

After the acute stage is over, an appraisal should be made to determine the degree of paralysis in various muscle groups. This gives a base line from which to estimate the return of function. The chief methods of restoring the function of the muscles include the intelligent use of heat, gentle massage, active and passive movements, electrical stimulation. If possible such treatment should be supervised by an experienced person, because the best results are thus obtained. There is a tendency for the inexperienced to proceed too rapidly, resulting in more harm than good. Under-water exercises are valuable because of the lessened resistance of gravity, the increased circulation due to heat, and the sense of well-being that the patient has in warm water. However, unless treatment is carefully supervised, the healthy muscles may be over-developed with resulting damage to the paralyzed ones.

Under treatment, improvement may continue for 18 months after the acute stage. Those not treated early, may show improvement for a period slightly longer than this. After there is no more evidence of recovery, surgical procedures, such as muscle transplantation, joint fixation, and the like, may give better use of the part.

#### **The Effect of Climate Upon the Volumes of Blood and of Tissue Fluid in Man. W. H. Forbes; D. B. Dill, and F. G. Hall.**

*Am. J. Physiol.* 130:739 (Oct. 1) 1940.

A group of ten white laboratory workers on moving to a hot, damp climate for the summer showed on the average a small increase in the volumes of both blood and plasma, both absolute and relative to body weight and to surface area. The average change was +5 per cent, but the range was from -6 to +12 per cent. The interstitial fluid, defined as the fluid outside the cells and outside the blood vessels, decreased in the heat 11 per cent on the average, but the range was from -34 to +26 per cent. There was no difference between the colored sharecroppers, the white sharecroppers, and the laboratory workers while in Mississippi in respect to plasma volume per unit of surface area, but the interstitial fluid volume was 25 per cent higher in the Negroes than it was in the white sharecroppers or the white laboratory workers.

**Role of Massage and Physical Methods in Treatment of Fractures. Charles E. Kindersley, and John Bastow.**

*Brit. J. Phys. Med.* 3:142 (Aug.) 1940.

The place of massage in the actual treatment of fractures could be summarized as follows: (1) To reduce swelling to enable a plaster cast to be applied; (2) its use in muscles which are not immobilized by plaster casts or are available to such treatment where a plaster cast is not used; (3) the instruction of patients in detailed exercises to maintain muscular activity, and so lead to the most efficient massage of all-muscular action on the part of the patient.

In busy fracture clinics where the number of patients attending is considerable, the role of the masseuse as a physical instructor is very valuable. Organized classes where rhythmical exercises are carried out, if possible in time to music supplied by a gramophone record, have been found to be a great help. Here the helpful factors are a sense of emulation, the bolder spirits encouraging the weak, and the effect of the music in emphasizing the rhythmical nature of the effort required, and discouraging jerky and incoordinated movements. It is not necessary to restrict a class to patients suffering from a particular type of fracture, for each case, having been previously instructed by the masseuse in the particular exercise he must perform, takes his place in the class and performs his own individual exercise in time to the beat of the music. Thus fractured vertebrae cases will be flexing and extending the spine; Colles' fracture cases will be exercising the elbow and shoulder; fractured femur cases will be flexing and extending the knee and so on.

As an adjunct to massage the author recommends the use of heat for relaxation of spasms, electric stimulation for its tonic effect on poorly functioning muscles, ionization for reduction of early scar tissue and hydrotherapy for its beneficial effects on structures in need of exercise un-

der water. He stresses the inherent benefits to be obtained by an intelligent regime.

**Pelvic Tuberculosis. A. H. Lahmann, and S. F. Schwartz.**

*Am. J. Obst. & Gynec.* 40:439 (Sept.) 1940.

Marked differences of opinion exist as to the method of treatment of genital tuberculosis. Most gynecologists advocate conservative surgical measures while others perform subtotal hysterectomy and bilateral salpingectomy, but sparing the ovaries wherever possible. The mortality rate is reported to be 10 per cent higher when conservative operations are performed, but prognosis of medically treated cases is grave. Although these surgeons endeavoring to remove only diseased structures from the pelvis are following sound gynecologic procedure, they err in that it is impossible to determine the amount of tuberculous involvement of the various structures macroscopically. When the tubes are involved, the surgeon has no alternative but to perform a bilateral salpingectomy, since bilateral involvement is estimated in as high as 90 per cent of the cases. Some authorities insist that tuberculous involvement of the salpinges is always bilateral. Attempts to spare the uterus in these cases is also considered hazardous, since uterine tuberculosis is estimated to exist in well over 50 per cent of the cases revealing tuberculous salpingitis. One or both ovaries may be spared if they do not appear involved, but this should be done with great caution since involvement cannot be ascertained without the aid of the microscope.

King is convinced that surgery should not be performed in presence of active pulmonary tuberculosis, since the pelvic involvement is not as serious, and surgery may tend only to aggravate the chest condition. He feels that the essential part of the treatment then becomes heliotherapy in a sanatorium, a procedure the importance of which cannot be overemphasized.

**Discussions of Papers by Dr. Oscar B. Nugent, Miss Vivienne Ilg, and Dr. I. S. Tassman.**

(Continued from page 240)

ophthalmologist in the average office who might care to equip himself that way, certainly extensive equipment is not necessary. Certain of the fundamentals might enable him to carry on the procedures that he feels are necessary in his work.

I like Dr. Wolpaw's common sense attitude and practical attitude toward orthoptics, and I think we all should have the same view and determine in the beginning as nearly as possible whether or not we are going to be able to benefit a particular patient, adult or child. We have found in recent years many adults presenting difficulties that we have not been able to overcome or otherwise can be benefited.

**Dr. A. D. Ruedemann** (closing): I hope

that we all don't assume the attitude of Dr. Wolpaw that children at five, six, and seven years of age can't be measured for muscles. You must take under consideration that Wolpaw is a bachelor, and children are pretty hard for a bachelor. The orthoptic technicians and persons who are working with children and have to handle them for many years can get muscle balances if they work with them and bring them into the office two or three times. As a matter of fact, that is the time when it should be measured. There is no good in being measured when they are ten, eleven, twelve, or fourteen years of age when they have developed a good myopia. One might as well get them late and correct them cosmetically.